SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LII.—No. 22. [NEW SERIES.] NEW YORK, MAY 30, 1885. [$3.20 per Annum. [POSTAGE PREPAID.]

PROPOSED BRIDGE OVER THE ST. LAWRENCE RIVER.

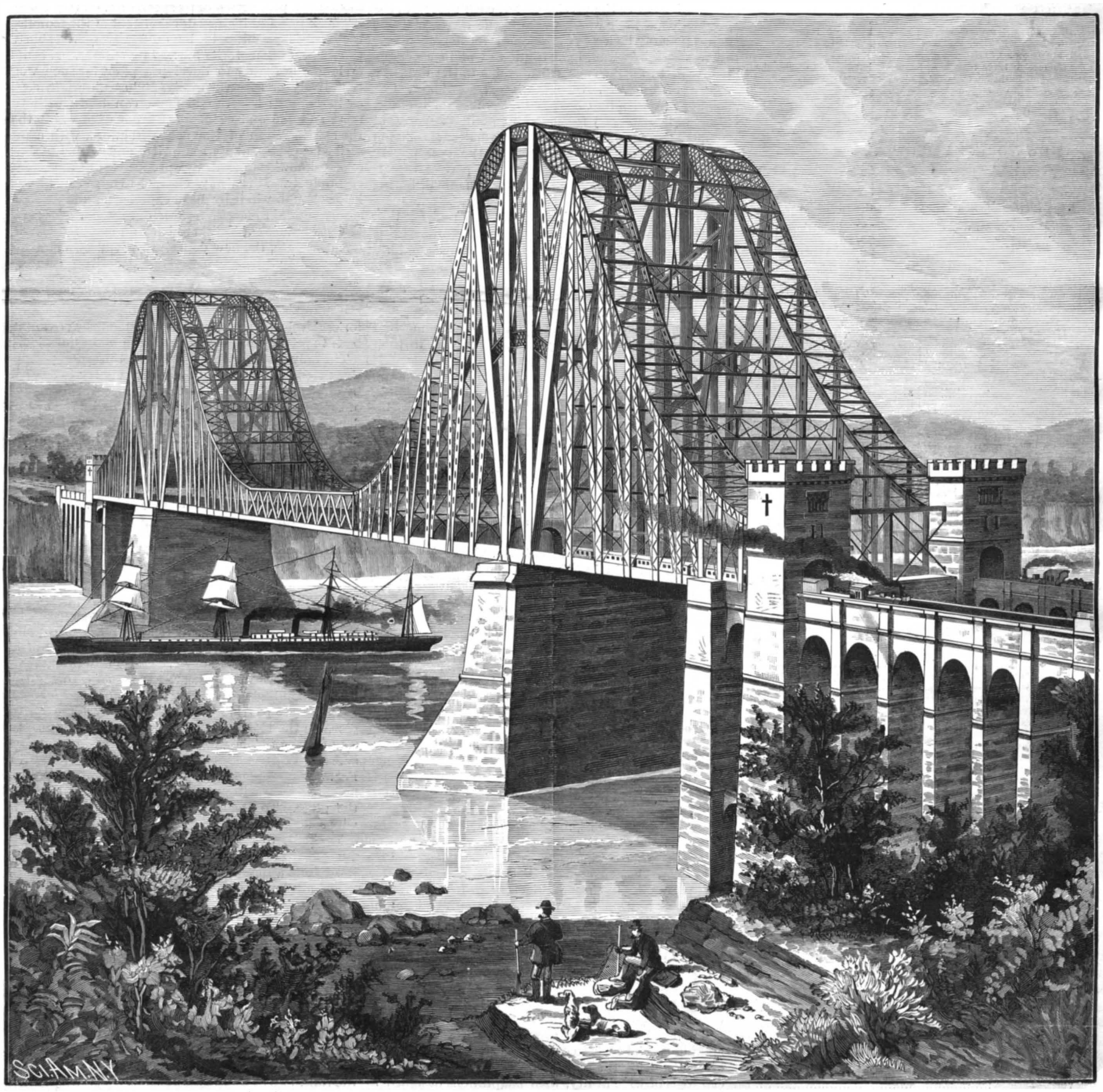
The Canadian Government, recognizing the great benefit which would be derived from a railway communication across the St. Lawrence, has sanctioned the proposal to construct a bridge at a point a few miles from Quebec. The accompanying engravings show the bridge proposed by Messrs. James Brunlees, A. Luders Light, and T. Claxton Fidler.

At the site selected the St. Lawrence narrows to a width of 2,390 feet; a large part of each shore is either very shallow or dry at low water, but for about 1,400 feet the depth increases, being at the center nearly 200 feet. The side elevation of the bridge shows the contour of the river bottom, and location of the two piers.

The bridge is of the cantilever form, and will be built entirely of steel. The length of the superstructure composing the three main spans will be 2,800 feet, the two cantilevers being united by a short latticed span. The distance from center to center of piers, the upper faces of each of which will be provided with massive masonry ice breakers for a height of 60 feet to guard against the drift ice, will be 1,550 feet, and in the clear the central span will be 1,442 feet. The clear height above high water will be 150 feet. The lower members are horizontal, while the upper ones of each cantilever form parabolic curves, which, beginning at each end, rise toward the piers, where the cantilever has a depth of 258 feet. The upper member is supported from the pier by four steel pillars, the two center ones being vertical, while those at the sides are inclined. The land end of each cantilever is anchored to a masonry tower.

The superstructure consists of two single track railroad bridges, placed 90 feet from center to center, and joined together by bracing; the arched masonry approaches consist of two single track viaducts, also placed 90 feet apart. The masonry arches are 40 feet span, and 150 feet high. The extreme width of the bridge is 108 feet. At the level of the railway is the plane of the main wind bracing, the flanges of the wind girder being formed by the lower members of the cantilevers. This general arrangement offers the best and most solid construction to resist the effect of wind pressure. The towers are rigidly braced in transverse and horizontal planes, and the upper chords of each single cantilever are united by upper wind bracing, the girders so formed being 17 feet in depth. A wind pressure of 56 pounds per square foot has been provided for, and the bridge has been designed to carry the heaviest traffic covering the entire extent of both lines of railroad. The maximum stress in the steel members will be 7½ tons per square inch of sectional area, while the stress in members of the wind bracing, exposed to alternating strains in opposite directions, will be five tons.

(*Continued on page* 340.)



PROPOSED BRIDGE OVER THE ST. LAWRENCE RIVER, NEAR QUEBEC.

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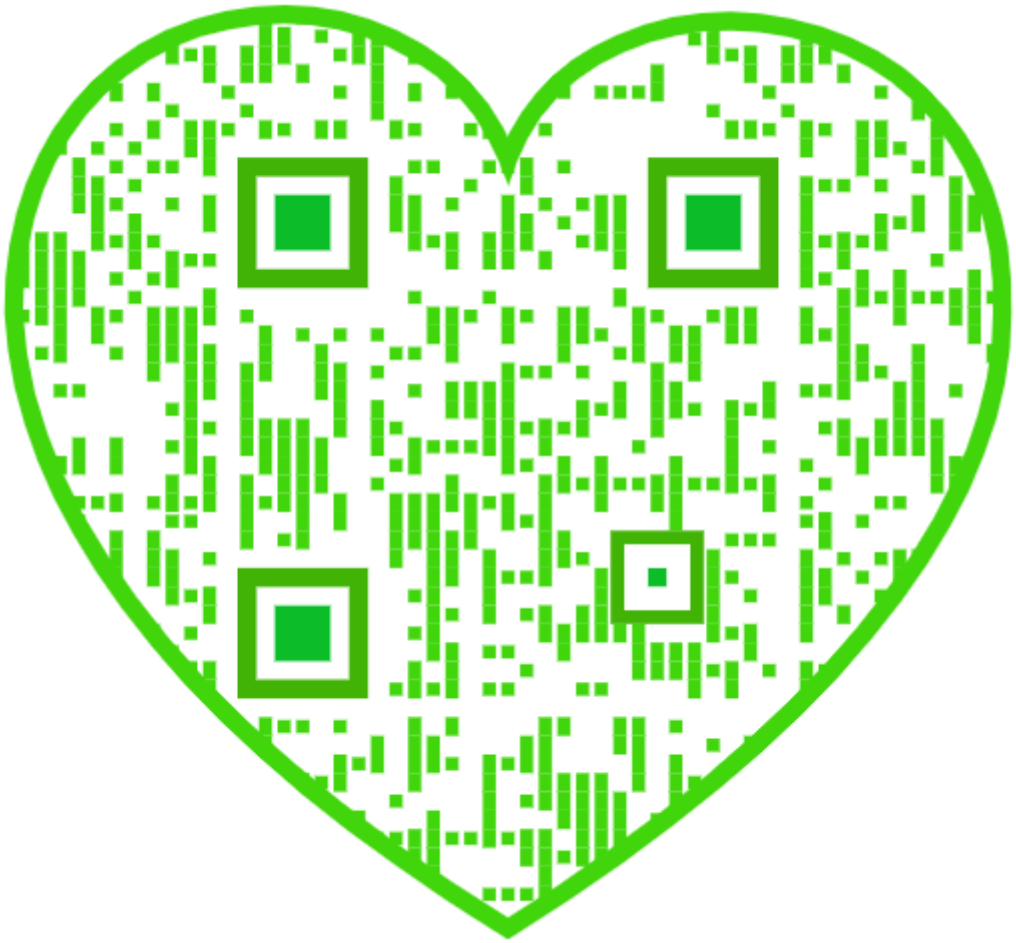

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

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NEW YORK, SATURDAY, MAY 30, 1885.

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THE HIGHER ORGANIZATION OF MANUFACTORIES.

"It is surprising how many manufacturers have to be burned out to discover what their goods cost them."

So said an adjuster of losses for a fire insurance company, the other day, speaking of the happy-go-lucky way in which manufacturing—particularly of patented specialties—is apt to be carried on. So long as the business, as a whole, is profitable, no critical attempt is commonly made to learn the precise cost of any single article or detail.

Some day a fire occurs, damaging or destroying a quantity of finished and partly finished products. Then arises the question, What was the exact value of such articles at such and such stages of manufacture; not their selling price, but their actual cost to the maker?

From data furnished by the manufacturer, cost of raw material, labor, wear and tear of machinery, shop rent, interest, and so on, a careful calculation is made, giving results which frequently surprise and not infrequently astound the manufacturer, who thus learns for the first time the prime sources of his profits or losses. Very often articles which were roughly supposed to be paying handsomely are found to cost more than they bring, the real profits of the business coming from other sources. More than one instance was cited by the speaker above referred to, in which the exact information developed through or incidental to a fire has been used as a basis for a thorough reorganization of a business, to its permanent benefit.

While the business was "booming," the proprietors, even if they had the requisite mathematical skill, had neither time nor incentive to enter upon any elaborate calculations as to the precise cost of each process in the production of their wares, to see if the aggregate cost might possibly be lessened by some minute percentage.

They certainly would not think to call in a competent expert to make such calculations in the ordinary course of business. Something extraordinary, like flood or fire, with its concomitant conflicts of interest, seems to be necessary for that; though it is a matter of common experience, and should be a matter of common expectation, that leakages occur in the best paying business, and that few processes are so perfect that it is safe to rest too long on the easy custom of letting well enough alone.

There are other occasions than flood and fire that compel judicious and far-sighted manufacturers to revise their methods; among them, dull seasons and hard times. Many, we doubt not, are now readjusting their machinery and processes to meet more effectively, not merely the conditions of production hitherto existing, but those of the immediate future, with its lower prices and keener competition. Is it not safe to assume that many others are neglecting the opportunity, to their future hurt?

The fact that a business pays is not always a guarantee that it is wisely managed. The real question is, Does it pay as well as it might? Where the possible margin for profit is small, as in the production of most staple goods, the manufacture is pretty sure to be conducted with scrupulous safeguards against needless wastage and excessive cost. It is with better paying specialties, which are in the best sense monopolies, that such economies are lacking.

Chief among the sources of avoidable loss is an absence of critical estimates of cost and a lack of thorough organization of men and machinery. Work is done by hand by high priced workmen, when it could be done better with cheaper labor, using intelligently selected or properly constructed tools and machines designed for the specific work to be done. Another source, less commonly recognized, is the lack of a nice adjustment of the manufacturing plant, in quantity as well as in kind, to the amount of work to be done.

The economic importance of the American system of production by means of special tools and machine tools turning out interchangeable parts is now understood the world over. It is everywhere recognized as marking the most important advance in the broader methods of the useful arts that our modern manufacturing age has witnessed. Not so many are aware that there is now in process of evolution a still more significant advance in the productive arts, economically considered, a higher differentiation, which promises to effect for mechanical production in the gross as signal an improvement as machine tools, with interchangeability of products, has effected in the details of manufacturing. It applies to the manufactory as a unit, and its output as a whole, the economy which the machine tool accomplishes in respect to the single product, and promises a proportional advantage to the public at large in the cheapening of all manufactured articles. It involves the organization of the highest grades of mechanical knowledge and skill, for a broader and higher type of mechanical business, which cannot fail to react powerfully upon all lines of production.

The new business has grown out of the business of making special tools to order, the second stage of the evolution being the production of specific lines of special tools of wide utility, with adaptations designed to meet the exigencies of special manufactures. The final step marks a complete and radical change in the furnishing of workshops.

At first the manufacturer who discovered the need of a special tool had it made more or less imperfectly in his own shop, often with serious delays and expenses which a shop especially designed for machine making could easily lessen or obviate entirely. The latest advance is for the intending manufacturer to order his shop in bulk, made to measure, so to speak, as he formerly would have ordered a single tool. He submits the machine, apparatus, or other articles which he intends to manufacture, or models or drawings of them, for an estimate—first of the proper cost of the machine or article when made by proper tools and processes in a properly organized factory; second, of the cost of producing such tools; third, of the cost of an entire plant capable of turning out the articles required, at the specified cost for labor, and in the quantity demanded, the organization of the factory to show the best possible adaptation of means to the desired end.

Here, it is obvious, is the basis of a new line of business of vast possibilities and enormous industrial importance, and it is gratifying to know that more than one American firm of large capital and corresponding experience and trustworthiness is making it a considerable part, if not the whole, of its business to provide in this way complete and thoroughly organized establishments for any and every variety of productions, from steam engines to sewing machines and fire arms.

It is obvious, too, that no ordinary shop can compete either in the quality or the price of its products with an establishment fitted out from the start with special machinery in this manner, with a plant rigorously and skillfully planned and constructed for the economical production of its specialties.

This latest and highest development of the manufacturing arts promises to be especially serviceable to those founding factories for new inventions. It is now no longer necessary to develop a plant for such work tentatively or experimentally, and at uncertain costs, as heretofore; but the business can begin with the most suitable and economical productive outfit that the existing state of the arts will afford, with a prescribed capacity, at a fixed price, and with a basis of expert knowledge as to the proper cost of the intended products. It is always cheaper to buy expert knowledge than to win it by hard experience; and easier to secure capital to meet a known outlay, however great, than to induce capitalists to back an uncertainty.

At any rate, the new departure promises, as already observed, to advance materially American manufactures in respect both to quality and cheapness. Where superiority comes with diminished cost, as it must in the better equipped and better organized manufactories developed under the new system, the advantage both to producers and consumers cannot be questioned.

The only possible sufferers will be those non-progressive people at home or abroad who may try to compete by old time methods with those who avail themselves of the superior facilities made available by the new order of things in the equipment and organization of manufactories. The manufacturer who continues to work in ignorance of the real cost of his products, or uses ill-adapted and inefficient machines and processes through ignorance of possible better ones, is a needless waster of wealth, and has only himself to blame if driven to the wall.

General Lafayette and the Bartholdi Statue.

In stimulating the people to opening their pockets for the completion of the granite base of the statue of Liberty, the N. Y. *World* deserves credit. By persistent daily appeals through its columns over $50,000 has been received at the *World* office. The *World* points out that Lafayette gave away about $140,000 of his private fortune during our Revolution, to promote the cause of American liberty; the question is then asked, how, remembering this, fifty millions of free Americans can refuse to provide the means to pay for a resting place for the statue of Liberty sent to us by Lafayette's countrymen? The question would remain unexplained, except to those who have visited the burial spot in Paris, where the brave General's bones are deposited, and have been witnesses of the neglected condition of the place. To such as these, the question will arise why some measure has never been taken by our patriotic people, to raise funds to erect a suitable monument to the memory of the gallant young officer who came from a foreign land to the aid of our forefathers, when men with strong heads and mighty arms and generous hearts were so much needed?

Railway Progress in the African Desert.

The *Times* correspondent in the Soudan telegraphs as follows: "The construction of the railway is a curious and interesting sight. In advance is a picket of cavalry, while far off on either side the vedettes scout in the bush. At the immediate head of the line is a battalion of infantry echeloned, and advancing as the rails are laid. Streams of coolies carry the sleepers from the trucks, and teams of four artillery horses drag up the rails, two at a time, to the navvies, who lay them in a twinkling, and drive the spikes. In the rear are gangs who complete the line, and further back the ballasting parties."

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ASPECTS OF THE PLANETS FOR JUNE.

SATURN

is evening star until the 18th, when he takes his turn in swelling the ranks of the morning stars. On the 18th, at 6 o'clock in the afternoon, Saturn is in conjunction with the sun, sweeping with his attendant rings and moons beyond the sun, and reappearing on his western side as morning star, hidden for a time in the sun's blinding rays, but keeping steadily on his westward course, until, when midsummer reigns, he becomes a beautiful object in the morning sky, one of the fairest gems that dot the firmament in the small hours that precede the summer dawn. He wins the place of honor on the annals of June, not so much for his arrival at the least interesting epoch of his course as for the fact that between his conjunction and the following opposition he will pass his perihelion, when he is nearly 100,000,000 miles nearer the sun than when in aphelion. Just now, however, Saturn is only the planet of promise. Safely hidden from mortal eye, he travels on his unseen path, coming toward us, and growing slightly brighter until his time comes to take on a visible presence.

Saturn, before conjunction with the sun, pays his respects to Venus, the former traveling toward and the latter receding from the sun on the star-strewn pathway. The planets are in conjunction on the 7th, at 5 o'clock in the afternoon, Saturn being 1° 32′ south when passing west of Venus.

Saturn, after conjunction, meets Mercury, the former receding from and the latter approaching the sun. The planets are in conjunction on the 23d, at 11 o'clock in the evening, Saturn being 1° 41′ south, when they meet and change places on the celestial road. The three planets have their meetings and partings all to themselves, for when these events occur the celestial actors are safely enshrouded in the dazzling halo of light that surrounds the sun, and are unseen by terrestrial observers.

The right ascension of Saturn on the 1st is 5 h. 40 m.; his declination is 22° 24′ north; his diameter is 15·6″; and he is in the constellation Taurus.

Saturn sets on the 1st a few minutes after 8 o'clock in the evening; on the 30th he rises about half-past 3 o'clock in the morning.

JUPITER

is evening star during the month. He is a superb object in the evening sky of June, the brightest of the three thousand stars visible on clear moonless nights. His course will be interesting to watch, for he is now moving eastward among the stars, or in direct motion, after having been for a long time either stationary or moving westward in retrograde motion, as it is technically called. Proof of this is easily discerned by observing the slowly increasing distance between him and the star Regulus, which he has now deserted for good.

At a recent meeting of the Royal Astronomical Society, in London, the Earl of Crawford made a very interesting statement in regard to one of the satellites of Jupiter. Dr. Copeland, he said, had recently observed a transit of Jupiter's fourth satellite, that is, the passage of the satellite across the planet's disk. While closely watching the phenomenon, he saw the satellite overtake and occult its own shadow on the body of the planet. Therefore, at the time of observation, the sun, the earth, the satellite, and the part of Jupiter's disk occulted must have been in one straight line. Under these conditions an observer on the huge planet, at the right point of view, would behold our earth, dwindled by distance to a tiny black sphere, making a transit on the sun's bright surface. But we fear that the grand phenomenon of a transit of the earth was invisible to observers on the Jovian disk, for there is hardly a possibility that life, even in its lowest forms, has yet developed on the gigantic globe, where primeval chaos still reigns.

The right ascension of Jupiter on the 1st is 10 h. 3 m.; his declination is 13° 8′; his diameter is 34″; and he is in the constellation Leo.

Jupiter sets on the 1st shortly before midnight; on the 30th he sets a few minutes after 10 o'clock in the evening.

URANUS

is evening star. On the 19th, at 10 o'clock in the evening, he is in quadrature with the sun on the eastern side. He then, as his three giant brothers have done before him, reaches the half-way house between opposition and conjunction, and thenceforth must be looked for in the western sky after the stars come out. He is nearly stationary during the month, and presents no other aspects worthy of record.

The right ascension of Uranus on the 1st is 11 h. 56 m.; his declination is 1° 9′ north; his diameter is 3·5″; and he is in the constellation Virgo.

Uranus sets on the 1st about 1 o'clock in the morning; on the 30th he sets about 11 o'clock in the evening.

MERCURY

is morning star until the 27th, and then evening star. On the 27th, at 10 o'clock in the morning, he is in superior conjunction with the sun. Since his previous superior conjunction he has made one of his swift circuits round the central orb in 88 days, and whirled on in his course till he has overtaken the slower moving earth, thus completing his synodic revolution in 115 days, and is in line with the sun and the earth. At this time he is beyond the sun, but he quickly reappears on the sun's eastern side, and speedily passes through his varied aspects as evening and morning star till he has completed another synodic period in less than four of our months. Years are short on the swift-footed little planet, one of them numbering but 88 terrestrial days, not quite three months as we count time!

On the 5th, at 2 o'clock in the afternoon, Mercury, approaching the sun, encounters Neptune slowly receding from the great orb. They are in close conjunction, Mercury being 48′ south. On the 23d, at 11 o'clock in the evening, Mercury, very near the sun, meets Saturn, also very near the sun. The conjunction of these planets has been already referred to. Mercury is the agitator of the brotherhood, and contributes largely toward making things lively in the sun's family.

The right ascension of Mercury on the 1st is 3 h. 10 m.; his declination is 14° 44′; his diameter is 7″; and he is in the constellation Aries.

Mercury rises on the 1st about a quarter after 3 o'clock in the morning; on the 30th he sets soon after half past 7 o'clock in the evening.

VENUS

is evening star. She is slowly and surely making her way to visibility, and her presence in the glowing west will be warmly welcomed. She sets an hour after the sun on the last day of the month, and bright eyes may then discern the fairest of the stars before she disappears below the western horizon.

She must be looked for in the northwest, half a degree south of the sunset point, in the constellation Gemini, south of Castor and Pollux and north of Procyon. Her high northern declination will aid the observer in his search. Venus is in conjunction with Saturn on the 7th, as previously referred to.

The right ascension of Venus on the 1st is 5 h. 11 m.; her declination is 23° 19′; her diameter is 10″; and she is in the constellation Taurus.

Venus sets on the 1st about a quarter before 8 o'clock in the evening; on the 30th she sets a few minutes before half past 8 o'clock.

NEPTUNE

is morning star. His path lies near that of Mars throughout the month. The planets are in conjunction on the 10th, at 6 o'clock in the evening, Neptune being 1° 29′ south.

The right ascension of Neptune on the 1st is 3 h. 27 m.; his declination is 17° 5′ north; his diameter is 2·5″; and he is in the constellation Taurus.

Neptune rises on the 1st about half past 3 o'clock in the morning; on the 30th he rises about half past 1 o'clock.

MARS

is morning star. At the end of June, Saturn, Neptune, and Mars are morning stars; Mercury, Venus, Jupiter, and Uranus are evening stars.

The right ascension of Mars on the 1st is 3 h.; his declination is 16° 45′ north; his diameter is 4·4″; and he is in the constellation Taurus.

Mars rises on the 1st about 3 o'clock in the morning; on the 30th he rises at a quarter after 2 o'clock.

THE MOON.

The June moon fulls on the 29th, at 14 minutes after 1 o'clock in the morning. She is in conjunction with Neptune on the 10th, and with Mars on the same day, six minutes later, showing how near together the planets are. On the 11th, the day before new moon, she is at her nearest point to Mercury; on the 13th, the day after new moon, she pays her respects to Venus, on the 17th to Jupiter, and on the 19th to Uuranus.

The moon occults Uranus for the fifth time since the year began. The occultation occurs on the 19th, and can be seen between the limiting parallels of 20° and 80° south latitude by those favorably situated in time and place. She also occults Alpha Tauri or Aldebaran on the 11th, for fortunate observers between the limiting parallels of 90° and 26° north latitude. The star and waning moon are both invisible when the phenomenon occurs.

OCCULTATION OF OMICRON LEONIS.

The moon, on the 16th, occults Omicron Leonis, a star of the 3½ magnitude in the constellation Leo. The immersion or disappearance of the star behind the moon takes place 7 minutes before 7 o'clock, a half hour before sunset. The emersion or reappearance of the star occurs 1 minute before 8 o'clock, 37 minutes after sunset. The emersion will be easily observed in a small telescope. The occultation continues 1 hour and 6 minutes.

JUNE

contributes an interesting budget of planetary events. The great sun himself is joint actor with the members of his family in three of them—the conjunction of Saturn, the quadrature of Uranus, and the superior conjunction of Mercury. Five of the planets, grouped near the sun and near each other, make matters lively, as they meet and pass on the celestial track, Saturn being in conjunction with Venus and Mercury, and Neptune with Mercury and Mars. The moon is not outdone by the more imposing members of the family, for besides paying her respects to each planet in turn, she occults Uranus, Aldebaran, and Omicron Leonis for the pleasure of fortunate observers in some portion of the terrestrial domains. Thus the month bears witness, as all previous months have done, and all coming months will do, to the never-ending succession of interesting phenomena, the wondrous variety, and the spiritual exaltation that rewards the faithful study of the queen of the sciences.

Prize for a Model of a Movable Ambulance Barrack.

The Empress of Germany offers $1,000 and a gold medal as prizes in a competition for a model of a movable ambulance barrack, subject to the following requirements:

The barrack must be suitable for use on the field of battle, or for epidemics, and so arranged that it can either form part of a larger hospital or an independent hospital. To be taken down easily, transported, and quickly erected.

It must form a stable building; arrangements for winter use should be added. Walls and floor must be capable of disinfection without difficulty.

The barrack should be large enough to contain twelve beds, allowing for each bed a cubic space of at least twelve meters. The only annex required is the closet, which may form a part of the barrack, or may be separate. The different parts must fit so that special workmen will not be required, either for erecting or taking down the building.

The floor, of planed boards, should not shake when walked upon, and should not come in direct contact with the ground. The intermediate layer between the ground and the floor should be such as to receive easily and promptly the nails of an improvised floor, in cases where the floor previously prepared cannot be used.

There should be sufficient ventilation, even in the cold season, when the windows and doors are closed.

The heating apparatus should be such as to keep the temperature of the interior at about 66° Fahrenheit. The heating apparatus might be made to assist in the ventilation.

Designs presented may be full sized specimens of the barrack, or models reduced one-fifth.

If a barrack is to be composed of a certain number of similar elements or parts, only one of these parts need be presented, provided that from it the whole can easily be understood. This condition applies only to full sized samples, and not to the reduced models.

Each competitor must present a plan of his whole building, with transverse and longitudinal sections, on a scale of one twenty-fifth; besides special plans for each part of the construction, for the systems of heating and ventilation, the manner of erection, the closet, etc., which may be either full-sized, or, according to the object represented, on a scale of one-fifth or one-tenth. The places for the beds must be indicated in the plan.

With the plan, there must be an exact description of the whole establishment, which must be written in French, German, English, and Italian. This description must cover the materials used, the particulars and details of construction, as well as the maneuvers necessary for pulling down, transporting, and erecting the barrack, also the time required for erection. It must also state the motives which guided the designer in his choice of materials and manner of construction. The designer should state what advantageous modifications could be brought to bear on his system, according to the country in which it was used, in relation to special climatic conditions, relative facility in procuring certain materials, and other local particulars.

The description should close with an approximate estimate of the cost and the weight of the barrack, a technical explanation of the sections used to show the different parts of the building, and finally a calculation of the operation of the heating apparatus and the system of ventilation.

Competitors will be allowed to represent their designs by plans only, provided such plans are accompanied by a description which fulfills all the above requirements. But those who send only plans will receive only honorable mention, not being allowed to compete for the prize of 5,000 francs.

Competitors should send their designs, etc., to Antwerp by Sept. 1, 1885, where they will be exhibited from Sept. 10 to Sept. 20.

The competitors should announce their intention of sending designs before July 15, to the "Commissariat General" of the Belgian Government, for the Exposition at Antwerp, 10*a* Rue de la Loi, Brussels.

For further information address the "International Committee of the Red Cross, Geneva," Switzerland.

SCIENCE has come to the aid of baseball players, and announces, for the benefit of batsmen who are ambitious to make heavy hits, that the ball should be struck at the angle of twenty-three degrees in order to send it to the greatest possible distance. Repeated experiments in artillery have proved that a ball fired from a cannon at this angle will carry farther than if fired at any other angle with a like charge of powder.

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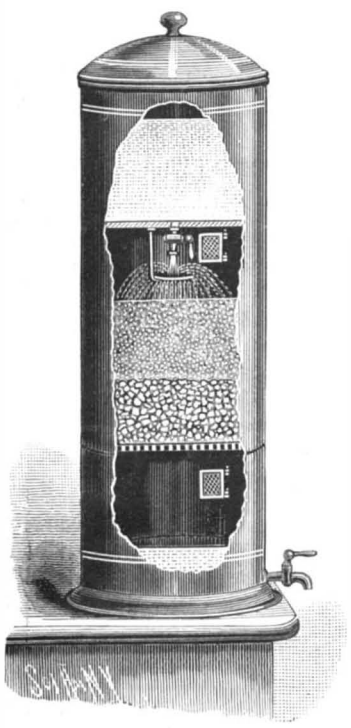
A NEW AND IMPROVED FILTER.

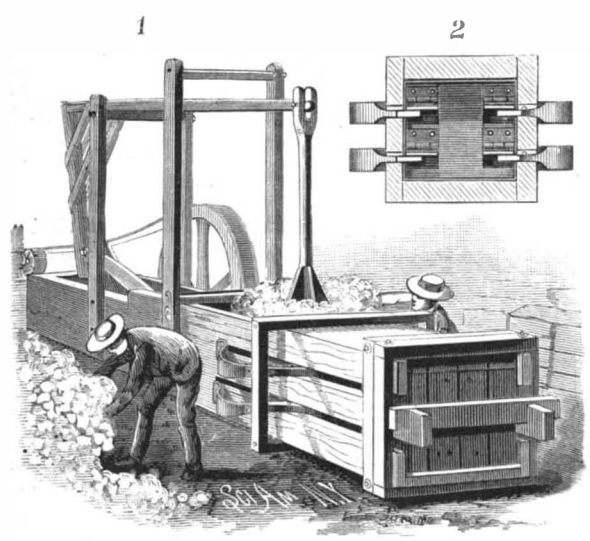
The filter shown in the engraving is continuous in action, and, owing to the complete aeration of the water, it never becomes foul, and has no substance like charcoal to become saturated after a time and useless. The inventor of this filter, Mr. Walter Dearden, of Trinidad, Colorado, has had one in use two years, and it does just as well now as at first. The body of the filter may be of wood, galvanized iron, or earthenware, and of any appropriate size. A horizontal partition forms a receptacle at the top to receive water. The flow of water from this receptacle is regulated by a cock.



Upon the perforated bottom of the next compartment is placed a body of gravel, above which is sharp, coarse sand. Under the cock is a distributing plate, upon which the stream of water strikes and is divided and distributed over the surface of the sand. Below the perforated bottom is the lower compartment, that receives the filtered water, which may be drawn out through the faucet. Formed in the body, just below the upper partition, is an opening, closed by a wire door, that permits free access of air to the compartment; through this opening the stem of the cock may be turned to regulate the flow of water. In the side of the lowest compartment is a similar opening for the passage of air to the filter below the filtering material, so that the water is plentifully aerated in the filter. This free access of air is of special importance in the center compartment, as the water, being divided into spray by the plate, will be brought into intimate contact with the air. The air will mingle with the sand, causing the water to be minutely divided, and, by oxidizing the impurities, will have a constant cleansing effect. The water is never permitted to enter in such quantity as to cover the sand.

IMPROVED BALING PRESS.

The engraving shows an improved press for baling hay or cotton, recently patented by Mr. Allen M. Brasher, of Alexandria, La. In the end of a horizontal baling box is a shaft formed at its middle with a crank, and on one end of which is a combined fly and pulley wheel. The crank is connected by a pitman with a follower block sliding within the baling box. In the top of the box in front of the follower is an opening through which the hay or cotton is fed. Journaled in two standards at the side of the box is a shaft carrying a rocking lever, provided at one end with a downwardly projecting arm which is over the opening, and at the opposite end with an inclined downwardly projecting arm braced and stiffened from the lever. The lower end of this



BRASHER'S IMPROVED BALING PRESS.

arm is so located that the rounded end of the pitman can act upon it. Pivoted in the inner ends of slots formed in the sides of the box in front of the follower (Fig. 2 is a cross sectional elevation through this part) are stops, on the outer ends of which are curved springs resting against the outer sides of the box, and thereby pressing the front ends of the stops, which are squared and larger than the inner ends, into the box. On the front end of the follower are two beveled grooves, to correspond with the slots in the box; hinged plates hang over the front ends of the grooves, and close them to prevent the entrance of hay.

At every revolution of the crank shaft, the rear end of the pitman strikes the lower part of the braced bar, and the follower is withdrawn as far as possible. The forward end of the lever is forced down, thereby pressing the hay or cotton into that part of the box in front of the follower. As the follower moves forward, the end of the pitman slides off the bar, which swings downward, thereby raising the opposite end of the lever. When the follower moves forward, the hinged plates push outward those parts of the stops projecting into the box; after the plates have passed the front ends of the stops, the latter snap into the grooves in the follower. When the follower is withdrawn, the ends of the stops swing the plates from the end of the follower, thus permitting the stops to pass out of the grooves. The stops prevent the hay that has just been pressed from moving back with the follower. It will be seen that the press is so constructed that it feeds itself automatically.

Decomposition of Blasting Gelatine.

According to Sir Frederick Abel, neither trinitrocellulose nor the less nitrated products are affected, when pure, by a temperature near 100°; but the easy decomposibility of gun cotton, sometimes observed, is due to the presence of nitro-derivatives of foreign organic substances (the incrusting matter of the cellular tissue), which, when heated, quickly decompose with the formation of free acid. In the *Journal of the American Chemical Society*, Professor Charles E. Munroe, U. S. N. A., reports the following case that has occurred under his own observation. Some camphorated explosive gelatine was wrapped in paraffin paper, then in light brown Manila paper, and laid on a shelf. After something more than a year's exposure, it was found, in the early winter, to be giving off nitrous fumes and to have shrunk considerably in volume, while the outside of the paper was covered with congeries of fine crystals. The odor of camphor was still quite strong. The mass was immediately put into a vessel of water. It was found to be friable, and, after a short immersion disintegrated. The camphor odor soon disappeared, and the water became of a straw color, gave a strong acid reaction, and showed traces of nitrous acid, but no nitric acid. On evaporation of the filtered liquid, oxalic acid crystallized out in quantity, and on evaporation of the mother liquor on the water bath a sugar-like mass was obtained, which gave the glucose reaction with Fehling's solution. The paraffin was regained unchanged, and the paper was recovered, but in a flocculent condition, and with the color bleached from the brown. Careful search failed to reveal the presence of glycerine, nitroglycerine, or gun cotton.

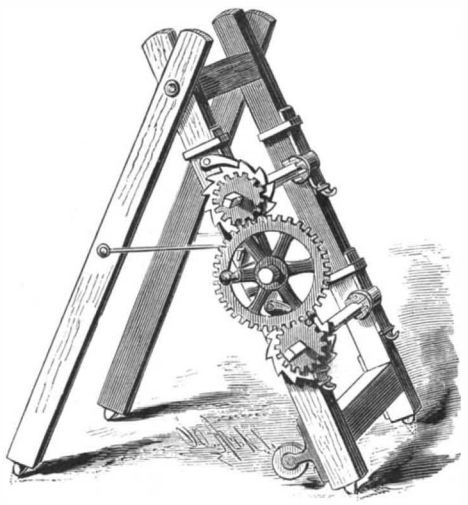
A Shoal Water Alarm.

In order to facilitate the navigation of the treacherous water of the Nile, Messrs. Yarrow have designed a permanent sounding apparatus which will notify the shoaling of the water some distance ahead. This is described as consisting of two poles about 50 ft. long, at the end of which are suspended two vertical iron rods. The bottom extremities of these come about 1 ft. below the level of the boat itself. One pole projects direct ahead from the port side, and the other from the starboard side. Attached to each of these two vertical iron rods is a wire rope which passes inboard, and is connected with the whistle on the boiler; and the gear is so arranged, that immediately this indicator touches a rock or sandbank it instantly causes the steam whistle to blow. This plan in the first instance draws the pilot's attention to the fact, and also points out to him on which side of the steamer the sandbank or rock exists, so that it gives him warning in which direction to steer.

WIRE CARRIER AND STRETCHER.

This apparatus—patented by Mr. William J. McKee, of Avon, Conn.—may be used in stretching plain and barbed wire for fencing and for rewinding the wire in removing fences; it can be operated with great facility, and requires but a minimum amount of labor. The frame consists of side bars connected by braces and provided with long arms, pivoted at one end, so that they may be set to support the frame in an inclined position, as shown. The frame and brace arms have spiked ends for entering the ground, and in the lower ends of the frame are wheels, which support the frame when it is brought down to near a horizontal position. Supported in boxes upon the frame are shafts fitted at one end with gear and ratchet wheels, the latter being engaged by pawls hung on the frame. The ends of the shafts are squared to receive crank handles, and a stud on the frame carries a large gear wheel meshing with both the small ones, and also having a handle by which it is operated. In order to weaken the bars as little as possible, and to permit of convenient removal of the parts, only the bottom portion of the boxes are mortised into the bars, and the upper portions are formed as straps, having hooks at one end passing beneath staples and held down at their opposite ends by bands around the bars. The shafts are to carry the reels of wire, and have on them sliding disks provided with sharp pins that can be forced into the wooden ends of the reels, so that reel and shaft rotate together.

The reels being placed on the machine, the latter is moved along the ground on the wheels, the brace arms being used as handles. When the wire has been run

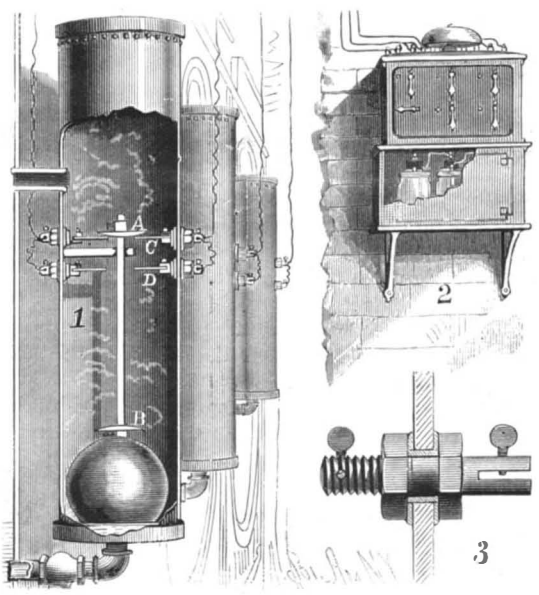


McKEE'S WIRE CARRIER AND STRETCHER.

off to the extent desired, the frame is set as shown in the cut, and crank handles are applied to the shafts—the center wheel having been removed—which are turned to stretch the wires. The pawls prevent backward movement while the wires are being secured to the posts, and the braces hold the frame against the strain. For winding wire, the braces are turned to the opposite side, and the large wheel is put in place to rotate both shafts at once.

ELECTRIC HIGH AND LOW WATER DETECTER.

A galvanized iron stand pipe about five inches in diameter, and of suitable length, is connected with the boiler by two pipes, as shown in Fig. 1. Within the pipe is a float having a stem a little longer than the range between high and low water. The stem passes through a guide, and has a copper disk, B, near the float, to signal high water, and another, A, near its upper end, to make the connection for low water. The hole in the guide is beveled to prevent the binding of the stem when the float shifts from side to side. The disks may be placed at any point on the stem. The electric circuit is completed through the binding posts, C D, which are connected with wires leading to the annunciator, Fig. 2. The inner end of each post carries a copper plate, with which the disks come in contact as the float approaches either the high or low water level, and in order to insure proper electrical contact, each plate is slitted into separate fingers in the bearing parts; the yielding of the fingers affords more certainty of connection with both plates, in case the float should happen to incline a little more to one side than the other. The disks are placed a considerable distance above the water, where they will not be liable to be



ELECTRIC HIGH AND LOW WATER DETECTER.

fouled with deposits. When several boilers are provided with the detecter, a multiplex annunciator, Fig. 2, is used, so that each boiler may be represented by a special signal. The binding posts are insulated from the stand pipe, by means of a rubber tube and washers, fitted through the holes of the pipe, and against the sides between the collar and nut, as shown in Fig. 3.

This apparatus is now in successful operation at the nail works of the Ellis & Lessig Steel and Iron Co., of Pottstown, Pa. When the alarm is sounded the annunciator not only shows which boiler is in trouble, but also indicates whether it is high or low water. Further particulars can be obtained by addressing the inventor of this device, Mr. C. H. Wickersham, P. O. Box 435, Pottstown, Pa.

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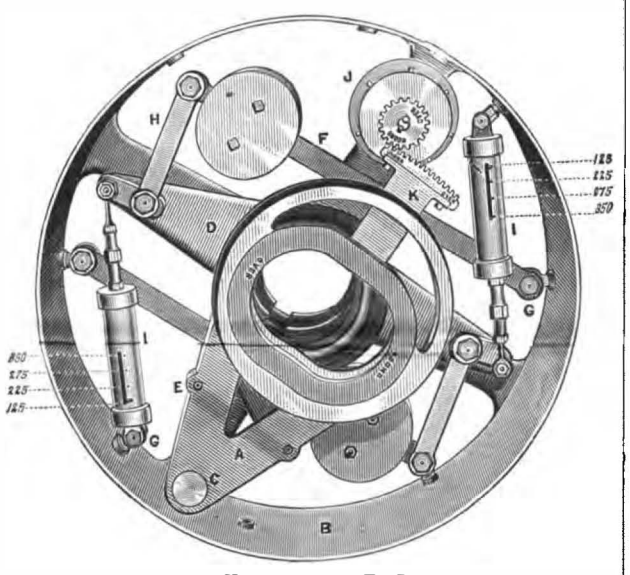
THE TAYLOR NEW AUTOMATIC STATIONARY ENGINE.

The competition among builders of stationary engines since electricity has attained such wide use is something almost phenomenal, and the improvements that have been made to secure a higher efficiency, more exact regulation, and smooth action at high speed mark a wonderful advance in steam engineering during the last ten years. The old fashioned cut-off has been almost entirely superseded by positive motion mechanism, and improvements in the governor have necessarily followed in rapid succession, and with these modifications there has also been a decided gain in simplicity, compactness, and working economy. One of the latest examples of improved stationary engines of this class, as made by the Taylor Manufacturing Company, of Chambersburg, Pa., is shown in the accompanying illustration. Its good proportions, both in general dimensions and arrangement of parts, and the proper form and sizes of details for the best uses of the forces developed, at once indicate its probable high efficiency for a large variety of work.

The primary elements of a good engine, accurate workmanship and the use of the best material, are points especially attended to, all parts being worked from carefully made templates and gauges, making them thoroughly interchangeable, and lessening the work of fitting to a minimum when the parts are brought together. The bed is heavy and rigid; its peculiar shape provides ample metal and strength above and below the central line of strain. The guides and head of frame are bored at the same time, thus insuring perfect alignment. The bearing for crank shaft is cast solid with the bed, and cannot spring out of line; it is lined with anti-friction metal, and being very long, will not heat. The base of the bed is designed to catch all oil from engine, and prevent its running down over foundation. The cylinder is secured to



THE TAYLOR ENGINE GOVERNOR.

end of bed, and overhangs; it is cast solid with steam chest, which is at the bottom of cylinder, so that all condensation passes off from bottom of steam chest.

The steam chest has steel bushings, in which the piston valve works. Should they become worn so as to affect the proper action of the valve, and leak steam, it only requires a short time to take them out and put new ones in. The valve is of the hollow piston type, fitted with packing rings. The edges of the rings are made to serve for the proper distribution of the steam, instead of the solid end of the piston. The valve is surrounded in the center, between the packing rings, with live steam, and exhausts through the inside, and, with the packing rings working in the steel bushings, will run without loss of steam from leakage. The steam ports are large and direct. Crank shaft and crank pin are of forged steel, and bearings are large and proportioned to work under the heaviest duty the engine can perform without heating. Crank disk is cast with counterbalance to balance weight of crank pin and connecting rod. Connecting rod is of best hammered iron fitted with gun metal boxes lined with anti-friction metal, and adjusted by a wedge inside the strap, which is operated by two bolts, so that when key is set the bolts secure it against working loose while running, and the straps surrounding the boxes are securely bolted to the rod. The crosshead has liberal bearing on guides, and is adjusted by sliding gibs. Piston rod is of steel, and secured to crosshead by a threaded end jam nut and key. Crosshead pin is of forged steel, set directly central of gib bearing on guide. Piston is fitted with two self-adjusting packing rings. All valve rods, eccentric rods, and pins are of forged steel. The eccentric rod is provided with a gun metal connection to rocker arm that can be quickly released, and valve operated by hand to keep engine off center. Rocker shaft is of steel working in a half box that is lined with anti-friction metal.

The governor of this engine is of novel construction, its action on the valve being instantaneous and positive. In the illustration, A is an eccentric pivoted to the arm of wheel, B. At D is sleeved arm that revolves on hub of wheel, B, and is connected to eccentric by links, E. The weighted lever, F, is pivoted to rim of wheel, B, at G, and by means of link, H, to arm, D. The weights are secured to lever, F, and by means of their centrifugal force act on the eccentric through the arm, D, and links, E, which links being connected close to the pivoted point of eccentric at C, there is only a small movement of weights required to produce full throw on or off eccentric. J is a paddle wheel or vane case, secured to arm of wheel, B, with toothed wheel in position, and connecting the paddle wheel directly to the eccentric by the toothed arc, K. The springs, I, act by compression, and when speed of engine is lessened, they overcome the centrifugal force of the weights, and increase the throw of the eccentric, which admits more steam, and restores the engine to its proper speed. The paddle wheel or valve revolving in the closed case, J, which is filled with oil or other liquid, is intended to act to prevent racing caused by sudden change of load, the movement of the weights propelling the wheel so that a slow movement is imperceptible, and will not be resisted by the oil, as would be a rapid one. A change of size of gear that propels the paddle increases or decreases its motion, but its action can only be coincident with that of the weights. The eccentric is connected directly to the valve, so that its action is instantaneous. The regulator can be adjusted for any speed of engine, and is independent of the fly wheel.

The company has a 16x24 engine of this type at the New Orleans Exposition, rated from 125 to 200 h. p., and has also sixteen other engines and two saw mills there, making one of the largest and finest displays in this line of any one firm at the exposition.

Patents on this engine were granted May 5 and May 26. For further particulars address the Taylor Manufacturing Company, Chambersburg, Pa.

Echoes from the Pulpit.

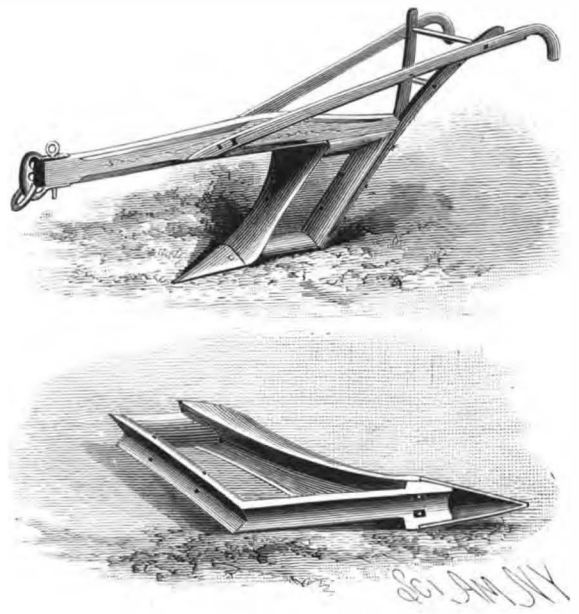
On Sunday, May 17, two of the widest known, and Brooklyn's most celebrated, divines made the following remarks during their morning discourses:

Mr. Beecher said: "I shall not be with you many more of the fast-going years. Steadily for more than fifty years I have been under the influence of the great doctrine of evolution. In my early preaching I discerned that the spirit of true religion was represented by the leaven of the mustard seed. Then I found that science had a larger view, and that this was only one application of a great doctrine. Now there is not an educated man under fifty years who is not substantially an evolutionist. The application of the fruits of evolution to all forms of doctrine—this will be the closing work of my life. I propose to discuss the questions of the Divine nature, human sin, the atonement, from the standpoint of evolution, and in the light that falls from that philosophy. I wish I could write it out, but I am beyond that."

Mr. Talmage said from his pulpit: "There sprang in Yucatan, on this continent, an herb that has spread throughout the world. In the fifteenth century it crossed the Atlantic, and captured Spain and afterward Portugal. Then the French ambassador took it to Paris, and captured the French empire, and Walter Raleigh took it to London, and captured Great Britain. Nicotiana is the name ascribed to that herb by the botanists, but we all know it as the exhilarating, elevating, paradising, nerve-shattering, dyspepsia-breeding, health-destroying tobacco. He could name at least five ministers whom he had known to die from cancer brought on from the use of tobacco. Over many a minister's grave the epitaph might with truth be written, 'Here lies a good and pious servant of God who died from too much Cavendish.' (Loud laughter.) In all the churches—Episcopal, Presbyterian, Congregational, Baptist, Methodist—there was need for reform. Tobacco was to be denounced also because of its cost. Give him the $15,000,000 a year, and he would clothe and feed all the poor in the country."

IMPROVED PLOW.

In the plow herewith shown, the point is detachedly connected by any suitable means. That section form-



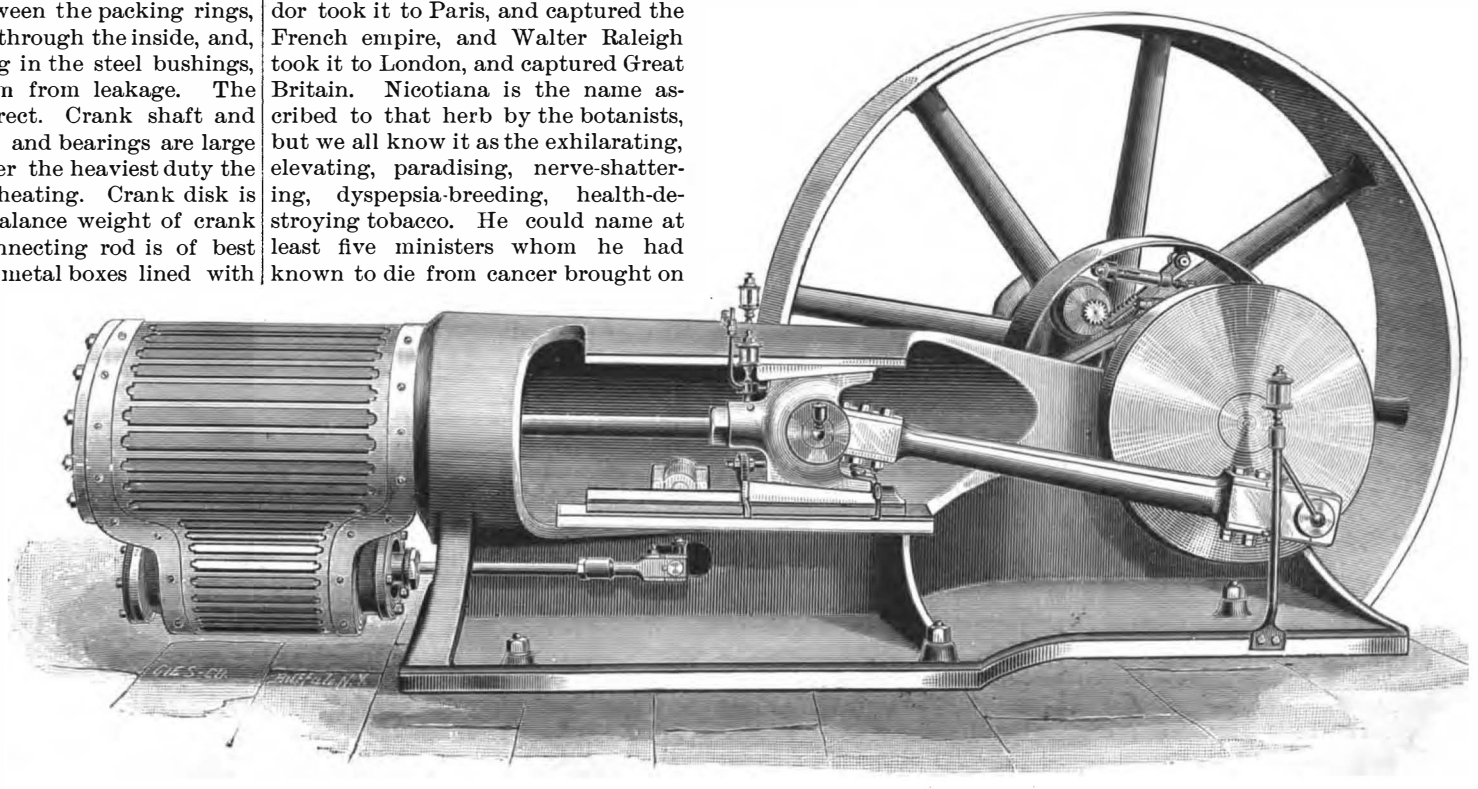
THE CLEVELAND PLOW.

ing the front of the plow has angular sides to cut and split the earth to be broken, also subsoiling and disintegrating the ground without simply turning it over. The effectiveness of this section is materially increased by its being curved inwardly. The frame is formed with a top groove and rear groove, which not only decrease the weight, but permit of the wooden attachments being held more securely and firmly in position, with the aid of screws or rivets. A groove is formed in the bottom of the frame, to enable the plow to be more easily and effectively guided in ground that is stony or otherwise difficult of management. This frame may be cast in one piece with the front curved portion of the plow, or made in sections and afterward connected together in any approved way.

This invention has been patented by Mr. N. A. Powell, of Lenoir, N. C.

Tapering Holes.

Some of the best bolt fitting is being done with tapering holes instead of straight holes. The holes are drilled straight, but are reamed with a reamer that is slightly tapering. The bolts are turned by fixed gauge to fit. The taper is really more than one one-hundredth of an inch—or on three inches, three one-hundredths of an inch—but is just sufficient to make a perfect fit when the bolt is home, and is enough to allow a slight tap of a hammer to start it back. Better fits can be made in this way than by straight holes, and work can be put together and taken apart much more rapidly.



THE TAYLOR NEW AUTOMATIC STATIONARY ENGINE.

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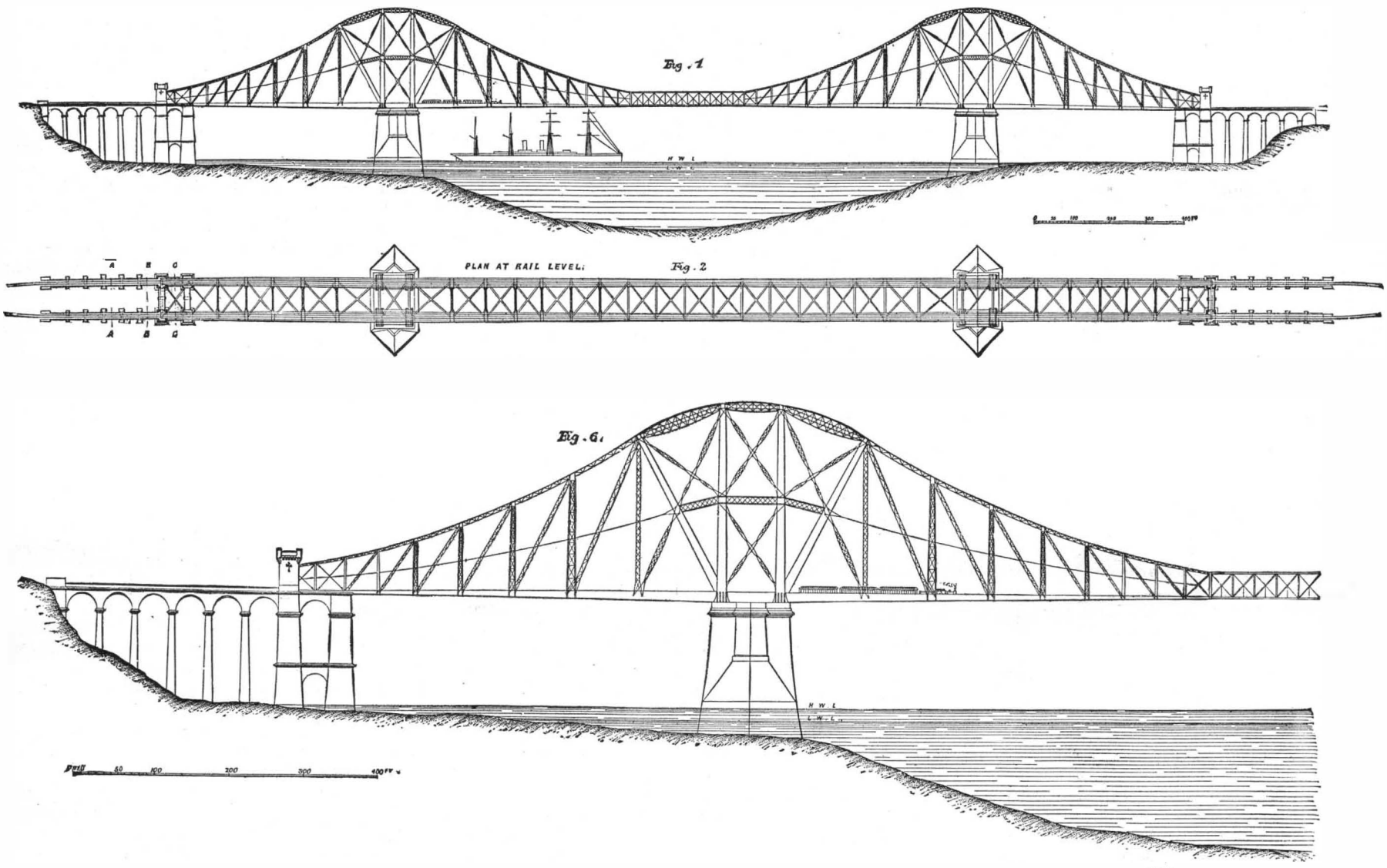
PROPOSED BRIDGE OVER THE ST. LAWRENCE RIVER.

(*Continued from first page*).

The side spans, between the piers and abutments, will be erected upon staging. After the erection of the main towers, a temporary wire cable may be extended across the whole span; and from this cable or series of cables scaffolding may be suspended. Although the cantilever will support its own weight as it is carried out, this system of scaffolding would greatly aid in the assembling of the parts of the several members. In building the lower member it will be practicable to roll forward the side girders, length by length, over the completed portion. The wind bracing will be carried forward in line with the cantilevers. The center latticed span may be erected either from the temporary cables, from false work on the ice in winter, or by building from each side toward the center.

Neither the width nor height of the center span could be reduced, since the largest ocean steamers pass up and down during the summer, and on the breaking up of the ice the narrow gorge here formed is choked with enormous masses of ice brought down from the lakes.



SIDE ELEVATION, PLAN, AND ENLARGED HALF SIDE ELEVATION OF BRIDGE OVER THE ST. LAWRENCE.

The Future of the Machinery Trade.*

The machinery trade of the United States has assumed immense proportions, surprising alike to our foreign competitors and to ourselves. This trade, instead of decreasing, as some suppose it will, should have a steady and healthful increase in the coming years. There doubtless will come periods of depression. Indeed, we have for some little time past been experiencing a reactionary condition in the consumptive demand, which has served as a material check on the progress of the trade, but this, we believe, is but a brief interruption, which will prove in the end as beneficial as at present it seems harmful.

In estimating the future demands for machinery, the following things should be taken into account: First, the natural increase in its use; second, the displacement of old machinery by new and improved devices; third, the replacement of worn-out machinery; fourth, its destruction by fires or other accidents.

In a decade the population of this country will be at the least calculation between sixty-five and seventy millions of people. During that period our exportation of manufactures must largely increase. It will be surprising if it does not double or treble. To supply the requirements of these extra millions of population and this increased trade there must be great demands upon our machinery makers. It must be remembered also that the tendency is constantly toward the use of more machinery—substituting mechanical for manual labor wherever it may successfully be done. This of itself makes an ever-increasing requirement for more and better machinery. The ease with which mechanical appliances can now be brought out has produced a tendency on the part of makers to furnish in some directions an oversupply, but obviously this applies only to general and not to special machinery. An inspection of the *Official Gazette* of the Patent Office shows that the spirit of invention is still rife, and that new mechanical contrivances are being brought forth with unusual rapidity. This means the future introduction of large numbers of new machines, the establishment of many entirely new industries, and the constant enlargement of the machinery manufacturers' field. It is safe to say that there is probably no department of this field which will not in the near future display a satisfactory increase in activity, unless, perchance, it be in those departments where old mechanical devices have been superseded by new. Old machinery is being constantly displaced by that of new and improved make. The old style engine gives way to the modern engine. The old tools are replaced with new and more accurate ones. The slow and tedious processes of the past are being revolutionized, and modern ideas and modern methods are brought into requisition. This mechanical evolution is going on all the while, and is increasing in extent yearly, as the number of mechanical improvements multiplies. The demand for new tools for replacing those in actual use is simply wonderful—so great, indeed, that few can fully appreciate the extent of this substitution. Closer competition will force upon manufacturers more and more a sense of the necessity for using better appliances. This will result naturally in an enlargement in the demand for machinists' work. There is a growing desire on the part of manufacturers to improve their plants by the substitution of better machinery, and we trust the time will come when every manufacturer will fully realize the importance of having only the very best equipment which money and skill can provide. This is the truest economy, and very many manufacturers fully understand the truth of this proposition.

The replacement of worn-out machinery will afford our manufacturers a vast amount of work. Think of all the machinery of the shops, factories, railroads, and for farm purposes that is now in use and deteriorating. The aggregate number and value of all this bulk of machinery defies calculation. What is its average life? At best but a few years, when it must all be replaced—some of it right away, but all of it in the not very distant future. Think of this mass of deteriorating machinery which is wearing or rusting out, and then conceive, if one can, of an idle machinery trade in the next quarter of a century. The plain truth is there is no more promising field in the world for the machine maker than this country. We have not mentioned the demand which will come for the replacement of machinery that is destroyed by accidents. Every day we hear of scores of accidents where boilers explode, factories with all their equipments are burned, where machines of one kind and another are broken, or where some accident produces injury to the plant, which requires new machinery to replace that damaged or destroyed. There is no reason for thinking that there will be fewer of these accidents in the future, but rather, as manufactories multiply, they will increase. There may be dull times in the future as in the past, but there cannot be permanent stagnation. The requirements of sixty to seventy millions of active and industrious people will alway be great, and, as we have shown, will furnish an increasing demand for the products of the machine shop. The machinist and the inventor will ever be important factors in our nation's history.

* The *Industrial World*.

Combustion in Dry Gases.

At a recent meeting of the Chemical Society, a paper entitled "Combustion in Dried Gases" was read by Mr. H. Brereton Baker, B.A. The author was led by the experiments of Mr. Harold B. Dixon on the explosion of certain gaseous mixtures, to investigate the effect of the presence, or otherwise, of moisture on the combustion of carbon and phosphorus in oxygen. Of these the experiments on carbon possess some interest from a gas engineer's point of view. Finely powdered charcoal was prepared for the experiment by heating to redness in a current of dried chlorine for three hours, and the tube containing it was subsequently transferred to an air bath and heated at 200° C., while a current of dried air was passed through it. Portions of a few grains each were placed in bent hard glass tubes, together with some phosphoric oxide for the purpose of absorbing any moisture that might be present; the tubes filled with dry oxygen, and sealed in the blowpipe flame.

Like portions were also placed in similar tubes, which were filled with oxygen saturated with water, and sealed. When one of each of these tubes was placed side by side over the large flame of a Bunsen burner, the carbon in the tube charged with moist oxygen burnt with bright scintillating flashes; but no apparent combustion took place in the tube containing dried gas, though it was heated to bright redness for several minutes. This experiment was successfully repeated before the meeting. The results of a series of experiments, in which the drying extended over various periods, showing the gaseous contents of the tubes after heating, were given in tabular form; and they clearly show that the burning of carbon is much retarded by drying the oxygen to the extent that is possible with the arrangement adopted by the author.

Soldering Flux.

One pound of lactic acid with one pound of glycerine and eight pounds of water is the new mixture of C. N. Waite, of Littleton, Mass., U. S. It is a substitute for chloride of zinc.

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A Natural Stream of Tar.

In a rugged, almost mountainous, portion of Kentucky, embraced in the county of Breckinridge, in that State, will be found unmistakable evidences of a great upheaval of the earth, in the long distant past, in the prehistoric age. So great was this convulsion of mother earth that beds of rock miles in breadth and from one hundred and fifty to two hundred feet in thickness were forcibly torn apart and separated at varying distances of a quarter to a half mile. In the valley made by the rent in the solid rock small rivers or creeks run their tortuous course, some of them of sufficient size to afford water power to turn the wheels of various mills situated at eligible sites along the streams, the banks of which are skirted by narrow strips of fertile land level enough for cultivation and very productive, while on either side of the stream the riven rocks will be seen to rise as towering, majestic cliffs. So uniformly similar in outline are these opposing cliffs that, should the hills be forced together, the edges would interlock and fit together like the two halves of an apple which had been torn apart. Ascending to the top of the cliff, the table lands which spread out for many miles are heavily timbered, and when cleared make productive farms, the houses of prosperous farmers.

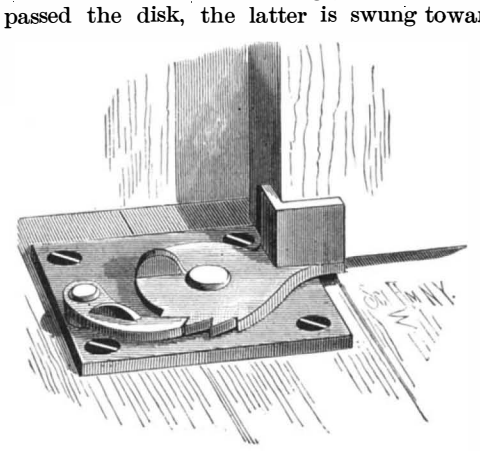
An interesting feature of these romantic cliffs will be found in the fact that when the rock beds of which they were formed were torn asunder and separated, the bottom portion was much softer than that nearer the surface, and, when exposed to the atmosphere, crumbled and fell out in piles below, leaving the surface or top of the rock overhanging and forming great rooms, some of them half a mile in length, protected by the overhanging rocks, and perfectly dry at all seasons and sufficient in size to amply accommodate large armies with complete shelter from storm and rain. They became resorts for stock in winter. So partial are the various kinds of animals to these comfortable retreats that some of them, particularly hogs, will remain under this shelter during long continued cold whether with snow, and, if not fed or driven out, will remain there and starve. These commodious rooms under the overhanging cliffs made comfortable homes for the Indians who inhabited this country before its discovery by the whites, as evinced by the discovery of large numbers of their flint arrowheads and other implements of savage life. Another notable evidence of their occupancy of these natural retreats from inclement weather is that after the softer portions of the rock nearer the ground had fallen out and crumbled to dust or sand, large portions of rock, ten or fifteen feet in length and several feet in thickness, would fall out from a position high up toward the surface, and, being of a much harder substance, would remain lying where they fell, and on the top of these the natives constructed or sank mortars to a depth of twelve or sixteen inches and about six inches at the top, gradually lessening toward the bottom. They manifested much skill in making these rock mortars exceedingly uniform and smooth in all their parts. What use they made of them is purely a matter of conjecture. Some thought they pounded their corn to hominy, others that they pulverized their material for making powder in them. Be this at it may, the mortars remain there in the rocks as inverted monuments to the skill of the red man. Many features of interest will reward the visitor to these scenes of a once violent convulsion in this part of the earth. The antiquity of this great upheaval is shown by large forest trees growing on the mounds made by the crumbling and falling out of rocks, which no doubt at first presented a clean break or perpendicular wall. In some places saltpeter is found exuding in its natural state from the rock one hundred feet from its top.

The most notable features of interest are the springs which flow from beneath these projecting cliffs. Among them are the tar and white sulphur springs, situated seven miles from the Ohio River, near Cloverport, Ky.

These springs flow from the base of a cliff which is one hundred and fifty feet high, and its top projects two hundred feet over the source of the spring, which is situated at the extreme back part of a commodious room made by the overhanging rock. This room is always dry, cool, and shady. The water is beautifully clear and cold, and the sides and bottom of the channel along which it flows are lined with a velvety coating of soft, snowy white sulphur, which adds to the crystal clearness of the water; but the most remarkable feature of these springs is a stream of liquid tar, the size of a small straw, continually running on the surface of the stream of water and flowing off into the reservoir provided for its reception. There may be a break in this stream of tar at times, but it is only momentary, when it is succeeded by another stream, and flows on and on as if it would flow forever. The supply would seem to be inexhaustible. For thousands of years this stream has continued to flow, night and day without interruption, as shown by banks of pitch ten feet in thickness and a hundred feet in width made by this small stream flowing off and evaporating the fluid portion, leaving a hard, dry, pitchy residue of the magnitude above mentioned.—*J. W. Compton, The Current.*

DOOR CHECK OR HOLDER.

The device herewith illustrated, lately patented by Mr. James W. Callaway, of Temple, Texas, is for holding doors open; it is simple in construction and effective in use. A disk is pivoted on a plate secured to the floor, a ring being interposed between the plate and disk to reduce friction. On the upper surface of the disk is a handle lug, and on its edge is formed a series of ratchet teeth. On the edge of the disk is a rectangular notch, from the edges of which flanges project upward. Pivoted on the plate is a pawl to engage with the teeth, and formed with a handle lug to facilitate swinging it toward or from the disk. When the door is to be held entirely open, the plate is placed on the floor at the wall; the plate may be placed at a greater or less distance from the wall. The notch faces the direction from which the door swings, and after the door has passed the disk, the latter is swung toward the



CALLAWAY'S DOOR CHECK OR HOLDER.

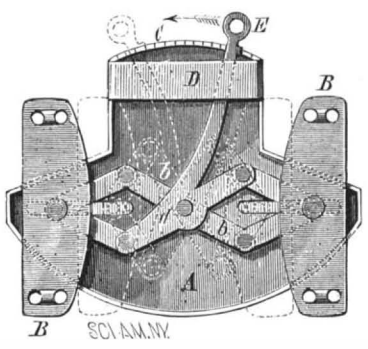
door, the flanges resting against the edge and face of the door. The disk is then locked in place by the pawl, which, when the door is to be closed, is swung back and the disk turned to swing the flanges from the door.

Cement Pipes for Drains.

Experience seems to show some special advantages in the use of cement pipes for sewers and drains, its adaptation to withstand the chemicals in sewage being satisfactorily demonstrated. It has been found that a mortar suitable for such pipe is best made by combining two parts of standard cement and three parts clean sand, the latter of various degrees of fineness, from the very finest to the size of one's finger end, and in such proportions that the finer fills up all the chinks, as the cement finally coats each particle and fills all remaining spaces. These materials are thoroughly mixed dry, and the mortar well rammed in the moulds. It is also important that the right amount of water be used; every particle of cement and sand should be wet, but the mortar be stiff enough for the rammer to bring up solidly on it, and press it firmly together instead of displacing it horizontally. The cores are usually drawn almost immediately after the pipe is finished, and in good weather the cases removed in about half an hour. The pipe is kept under cover about two weeks, and then put out into the sun and air, and well wet every day. The pipes thus made, the *Manufacturer's Gazette* concludes, may be ready for ordinary use six weeks after they are put out.

GLOVE OR SHOE FASTENER.

The edges of the metal plate, A, are bent inward to form flanges. Extending from near the ends of the tapered parts of the plate toward the middle are slots, through each of which passes a pin, also passing through the end joint of lazy tongs and held on a metal strip, B. One of the middle levers of the lazy tongs has an extension or spring handle, E, passing under a guard, D. The handle has a lateral extension adapted to engage with teeth, C, against which it is pressed by the spring tension of the handle. The strips, B, are fastened to the opposite flaps of a glove or shoe. By swinging the handle in the direction of the arrow, the pins in the slots are moved toward each other, and the flaps to which the plates are secured are brought together, and the shoe or glove is thus closed. The projection on the handle catches on one of the teeth, and locks the handle part and plates in place. The fastening is strong and durable, and by means of it the flaps can easily be drawn toward each other.



This invention has been patented by Mr. Edward W. A. Meyer, of 9 Pelham Street, Boston, Mass.

Erection of a Concrete Bridge in One Day.

The firm of Zurlinden & Co., of Aarau, having constructed a canal in connection with their works about two-thirds of a mile in length, were obliged by the town authorities to bridge it in two places. This they did by means of segmental arches of cement concrete, constructed to the designs of Professor Tetmajer, of Zurich. The dimensions of the arches—Proc. Inst. C. E.—are: Span, 39 feet 4 inches; rise, 6 feet 6¾ inches; thickness at crown, 1 foot 7¾ inches; thickness at abutment, 3 feet 3½ inches; thickness of abutments, 9 feet 10 inches; width of roadway, 13 feet 1½ inches. The foundation of both abutments is on fairly good gravel, at a depth of about 5 feet below the springing. Spandrel walls are carried up to the level of the roadway, and surmounted by an iron hand rail, the space between the spandrel walls being filled in with gravel covered with ordinary road metaling. The total weight of the structure between the abutments is 194 tons, or including a live road of 300 kilog. per square meter—61·5 pounds per square foot—211 tons. The first bridge was erected in two days in June, 1884, the two abutments being formed on the first, and the arch and spandrel walls on the second day. The bridge was brought into use after standing for about two months, and has been in constant service ever since for heavy-wheeled traffic without any sign of settlement or cracking. On the 9th of October the second bridge was completed between 6 A.M. and 6 P.M. by 65 men. The concrete was mixed in accordance with the recommendation of Professor Tetmajer, as follows: The cement and sand were first mixed dry, then the gravel added, water being gradually added during the mixing in such quantities that when the punning of the concrete was completed a thin film of water showed upon the surface. The concrete was mixed as follows:

	Cement vol.	Sand vol.	Gravel vol.	Pounds of cement per cubic yard of concrete.
Abutments.....	1	3	7	337·2
Arch.....	1	2	4	505·8
Spandrels..	1	2	6	421·5

The cost of such a bridge is given as:

	£.	s.	d.
Excavation 50 cubic meters (65 cubic yards) at 10 d.,....	2	1	8
Concrete, including centering, etc., 80 cubic meters (104 cubic yards) at 25 s.....	100	0	0
Filling in over arch, forming road.....	8	6	8
Iron hand railing.....	10	8	4
	120	16	8

New Rates of Postage.

On July 1 the following important changes will be made in the rates of postage:

1. Any article in a newspaper or other publication may be marked for observation, except by written or printed words, without increase of postage.

2. All newspapers sent from the office of publication, including sample copies, or when sent from a news agency, to actual subscribers thereto, or to other news agents, shall be entitled to transmission at the rate of one cent per pound or fraction thereof, the postage to be prepaid.

3. The weight of all single-rate letters is increased from one-half of one ounce each or fraction thereof to one ounce each or fraction thereof. The same increase of weight is allowed for drop letters, whether mailed at stations where there is a free delivery or where carrier service is not established.

4. A special stamp of the value of ten cents may be issued, which when attached to a letter, in addition to the lawful postage thereon, shall entitle the letter to immediate delivery at any place containing 4,000 population or over according to the Federal census, within the carrier limit of any free delivery office, or within one mile of the post office coming within the provisions of this law, which may in like manner be designated as a special delivery office; that such specially stamped letters shall be delivered between 7 A. M. and midnight; that a book shall be provided in which the person to whom the letter is addressed shall acknowledge its receipt; that messengers for this special delivery are to be paid eighty per cent. of the face value of all the stamps received and recorded in a month, provided that the aggregate compensation paid to any one person for such service shall not exceed $30 per month, and provided further that the regulations for the delivery of these specially stamped letters shall in no way interfere with the prompt delivery of letters as provided by existing law or regulations.

How Germs Get in the Lungs.

In the ordinary healthy lungs, perhaps even in persons who have a consumptive heredity, the germ which causes the breakdown of the lung may not be able to make an impression; but if the physical integrity is destroyed by poor food, or any debilitating influence, or by a cold, then the germ is able to get in its work, and to multiply and produce its kind, and fill the lungs with tubercles.—*Dr. Curtis.*

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MATHER'S PORTABLE ENGINE.

We illustrate a four-horse portable engine of a very simple type. As will be seen at a glance, the crank shaft and flywheels form the traveling axle and road wheels when the engine is being transported from place to place. The cylinder is single-acting, the connecting rod being pivoted directly to a crosshead cast with the piston. The boiler has two crosstubes, and is mounted on a wrought iron foundation plate. The chimney is fitted to a pair of malleable iron joint rings, and has a movable iron fork provided to receive it when doubled back for traveling.

The cylinder, guides, and framing are all in one casting; the framing joins the cylinder at its lower end, and may be compared to arms and legs, all of which are cast hollow. On the back of the cylinder is cast a bracket of the same radius as the boiler, to which it is secured by bolts. On the left leg is formed a hollow bracket, to which the feed pump barrel is bolted by two bolts; the joints, which are faced, are made with paper, for easy removal. The cylinder cover, or head, contains the steam and exhaust openings and piston valve, and also carries the governors. The piston is dished, and is fitted with two rings at the upper end and with one at the lower end, under the slide plates of the crosshead, which are adjustable. The pump plunger is screwed into the crosshead flange. The crank shaft, which is 3 inches in diameter, and of Bessemer steel bent to obtuse angles, carries the two traveling wheels, one on each end. One of these wheels is keyed firmly on the crank shaft, while the other has a set screw and glut, which is tightened before running under steam, and slackened before traveling, to allow easy turning of corners without skidding. The connecting rod is withdrawn from the crank bearing before traveling by simply driving out a cotter, so that none of the working parts are in motion. The crank shaft also carries a driving pulley. There are no eccentrics; the valve is operated by a bent forked lever, which is at its lower extremity joined to the connecting rod by a link. This rod forces the valve downward against the steam pressure. The height to which the valve can rise when the lever is lifted depends upon a wedge, which is moved in and out by the governor. Thus the steam port is more or less uncovered, according to the amount of work to be done by the engine. There is only one gland in the engine, that being for the pump rod, only one-half inch in diameter. The valve is not connected to the lever, but from the latter a short rod is suspended, which works into a semicircular groove, allowing it to lift during the time the governors hold down the valve. These engines have now been two and a half years under test, and give great satisfaction. They are at present made in two sizes, 2½ and 4 horse power. As the working parts are all in compression they seldom need adjustment, as no knocking would be heard even under considerable wear. Mr. G. R. Mather, of Wellingborough, England, is the maker.—*Engineering.*

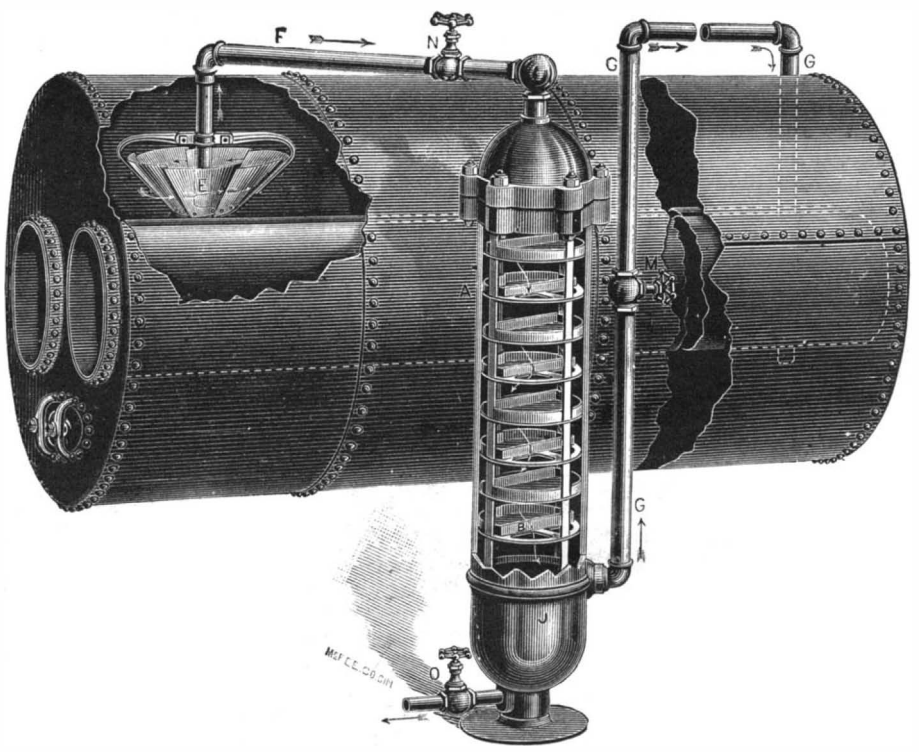
Nitrate of Soda Prizes.

The Committee of the Saltpeter Producers' Association at Iquique, Chili, offers $5,000 in prizes for essays on the use of nitrate of soda as manure. Of this amount a prize of $2,500 will be awarded for the best popular essay showing the importance of nitrate as a manure, and the best mode of applying it. It is desired that the essay should, in its theoretical part, exhibit the present state of knowledge on the effect upon vegetation of nitrate as compared with other nitrogenous preparations; and directions are also to be given for the use of nitrate as an aid to plant culture. A second prize of equal value is to be awarded for the best account of new and original applications of nitrate, based upon the researches of the author himself. A Committee of Judges, composed of leading agricultural chemists of all nations, has been nominated to receive these communications.

MECHANICAL BOILER CLEANER AND WATER PURIFIER.

The foaming of water in boilers has been the cause of ruining the well finished surfaces in cylinders and valves of many engines; and the engineer has been often perplexed to know just what to do when using muddy and impure water in the boiler, for it is well known that when mud and fine sand get into the cylinder, they penetrate to the innermost recesses of the piston packing and valves, and also the stuffing box glands, where they will remain for a considerable time, doing injury to the parts. The working of oil through the cylinder partially remedies the evil, but does not prevent the sand from cutting the surfaces of the inside of the cylinder and valves; and as the friction of these working parts is greatly increased, it requires an increased pressure in the boiler to keep the engine up to the usual speed, and more pressure with same speed requires more fuel.

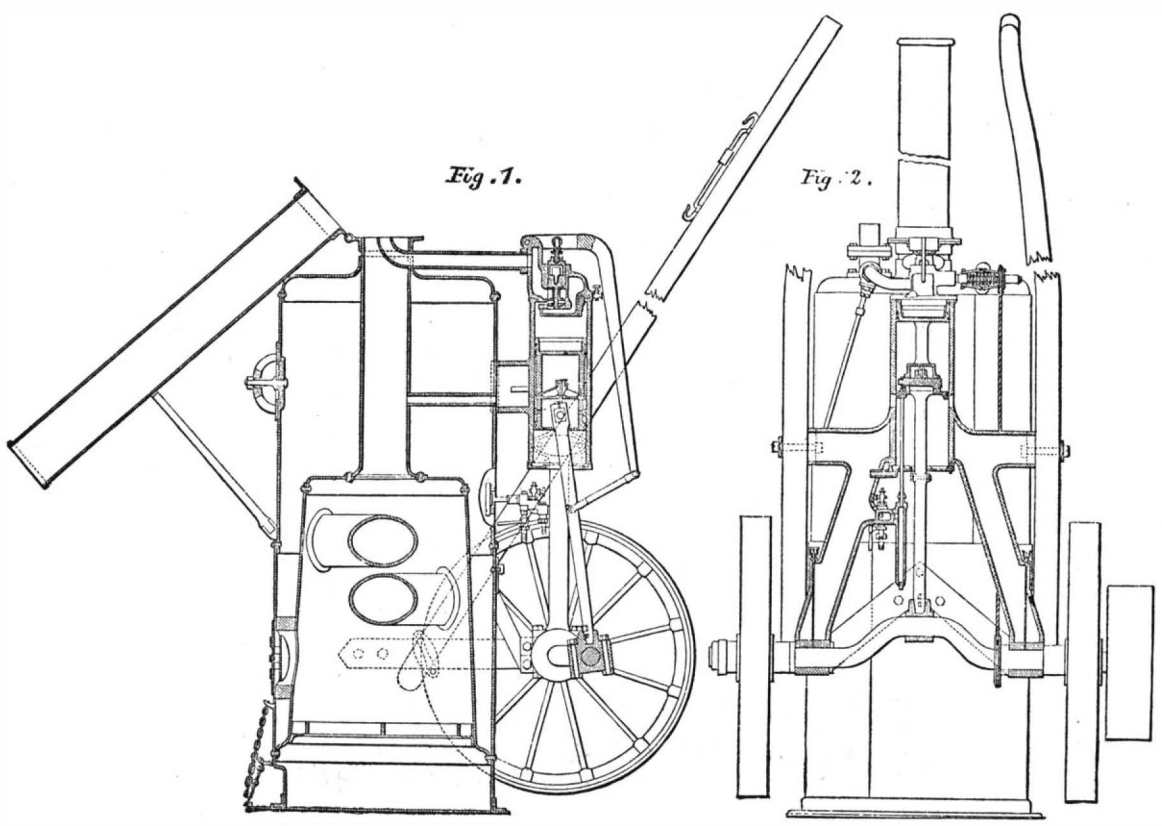
In the ordinary manner of getting the mud and sediment out of a boiler there is a loss in fuel, by the waste of heat contained in the water. Take, as an illustration, a boiler in which river water is used. Such water generally contains a more or less quantity of mud, sand, and vegetable matter. At night, before stopping, the engineer will usually pump the boiler full to the top gauge, and in the morning, before starting up, he will open the blow-off valve, in order to get rid of the sediment supposed to have settled on the bottom of the boiler. The water thus blown out carries with it an amount of heat equal to that required to heat an equal amount of fresh feed water, which will have to be pumped in to take its place. This blowing-off is usually repeated every few hours, each repetition being accompanied by loss of heat. These losses are additional to that caused by the sediment forming a covering on the inside of the shell and flues. This sediment, or scale, being a very poor conductor, keeps the heat from passing from the iron to the water, thus preventing the rapid generation of steam. It follows that a device which would remove the mud, sand, and vegetable matter held in suspension, and also the scale-forming matter held in solution, and return the water in its heated, but purified, state to the boiler, would not only cause a saving in fuel, but would protect the boiler and engine from injury arising from their presence. The device herewith illustrated claims to accomplish this result.



VAN DUZEN'S MECHANICAL BOILER FEEDER AND WATER PURIFIER.

The body, or reservoir, A, of the cleaner is made in two parts. Inside of the reservoir are from eight to nine settling tables, B, three-fifths of the upper surface of each one being formed into a basin or pocket, in which sediment collects; the other two-fifths being pierced with holes for the passage of the hot water which flows through the pipe, F, from its mouth in the centrifugal skimmer, E. The water is discharged into the opposite end of the boiler through the pipe, G. The mud and sediment are removed from the hopper, J, through the blow-off valve, O. The valves, M and N, are used only when washing out the cleaner. The skimmer is placed near one end of the boiler, with its bottom half an inch above the flues. The end of the pipe, F, is placed 1¼ inches above the inside of the bottom of the skimmer, and the open end of the pipe, G, is placed 15 inches below the top line of the flues. The arrows denote the course of the water through the pipes and cleaner. By the action of heat, currents of hot water rise and flow into the skimmer, and pass through the pipe, F, into the cleaner, where, being kept free from the agitation of the currents in the boiler, all impurities are deposited either on the settling tables or in the hopper at the bottom. The pure water then enters the other end of the boiler. To remove the sediment from the cleaner, the valves, M and N, are closed to shut off connections with the boiler, when the water and sediment on the plates may be discharged through the valve, O. Upon the valve, N, being opened, water from the boiler is forced upon any sediment remaining in the cleaner; the openings in each plate act as nozzles, through which the water is dashed into the basin of each settling table, and finally into the hopper at the bottom and out through the blow-off. Such a cleaner is automatic as long as the water in the boiler is hot, and creates a continuous circulation; it has a large settling capacity, and the mud and sediment can be rapidly discharged.

Any further particulars regarding this boiler cleaner may be had by addressing the inventor and manufacturer, Mr. E. W. Van Duzen, of 104 E. Second St., Cincinnati, Ohio.



IMPROVED PORTABLE ENGINE.

New Mode of Hardening Plaster of Paris.

M. Julhe describes a new process for hardening plaster of Paris, so that it may be used, among other purposes, for floor parquetting (*Comptes Rend.*, c., 797). It consists in mixing the plaster before using it for casting with one part in six of finely sifted recently slaked lime, and saturating the well dried casting with solution of a sulphate of a base giving an insoluble precipitate with lime. Sulphate of zinc and sulphate of iron are both suitable. The zinc sulphate gives a white material, while that containing iron is at first greenish, but upon drying takes the characteristic color of ferric oxide. A coating of burnt linseed oil converts this into a mahogany color, and a coat of copal varnish gives a fine surface. The casting should be well dried before treating it with the sulphate solution, and after being immersed not longer than two hours it should be again dried; it may then be replaced in the solution until the saturation is complete. The product is said to resist atmospheric influences, and when sulphate of iron is used, the resistance to fracture is said to be twenty times greater than in ordinary plaster.

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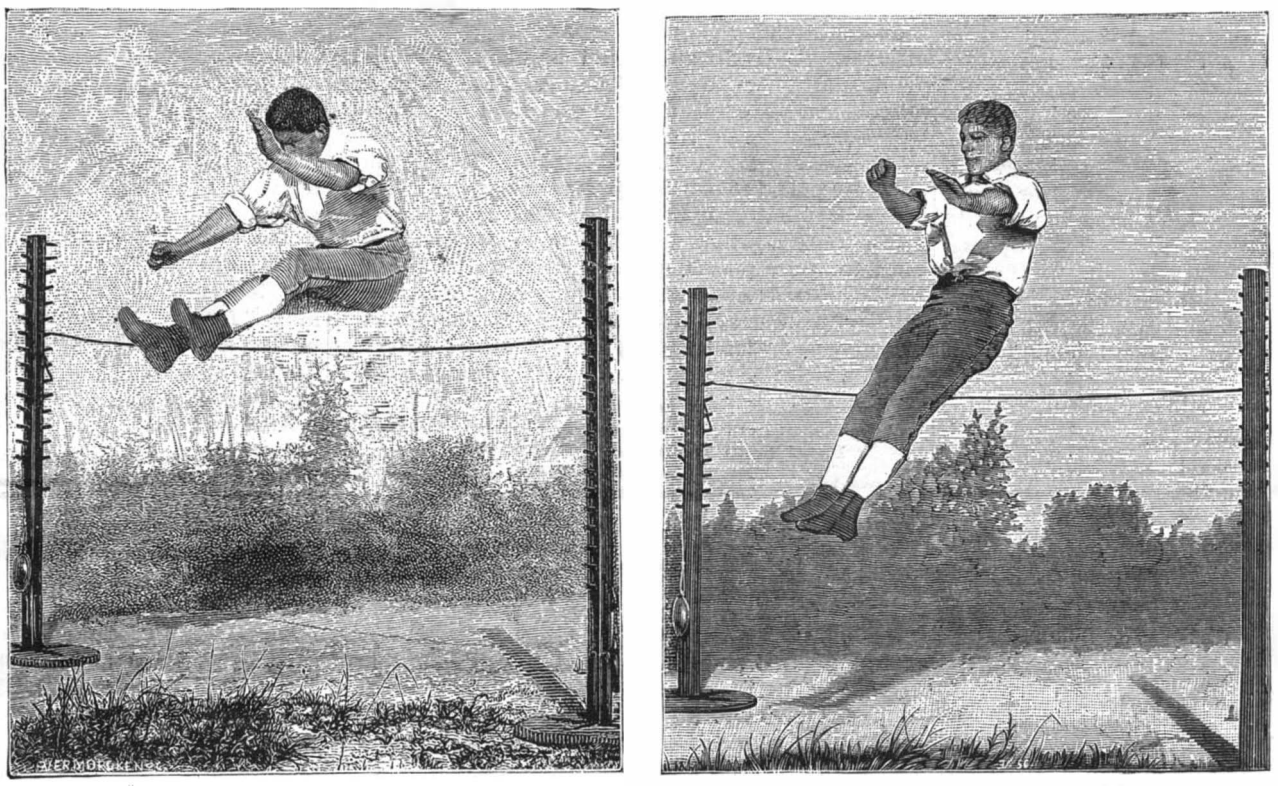
THE ART OF LEAPING.

Not every one can leap who wishes to, and those alone who exercise know how to do it. The gymnastic object of leaping is to pass over objects without touching or overturning them; its physical object is to accustom the muscles to receive hard blows without being incommoded thereby, so that at the moment of danger one shall run no risk of being wounded; and its moral object is to habituate the heart and head to bold and perilous acts, and, in case of danger, to take opportune and generous resolutions tending to save life, and to traverse wide spaces in the air without losing self-possession, as happens with those who do not exercise.



Figs. 1 and 2.—MAN LEAPING. (From an Instantaneous Photograph.)

It is useless to say that the progressive exercises that lead to leaping well must be conducted with much method and circumspection. We shall not enter into a detail of the rules that govern leaping; it suffices to say that it is necessary to study separately what relates to the mode of bending the legs and of lifting them at the moment of the spring and what relates to the manner of striking the ground again, and bending and rebounding. Afterward, what relates to the motion of the arms during the leap is taught; and, finally, all the motions that have been taught separately are united.

In order to diminish the danger of leaping, says Dr. Bourdon, it is necessary to look after the respiration when one falls upon the point of the feet, that is to say, it is necessary that the lungs shall have been filled with air before the fall, and that it be allowed to escape when one touches earth, because the shock is diminished by reason of the quantity of air that the open glottis has allowed to be expelled.

Physicians and philosophers have striven to give a rational theory of leaping, and, from the time of Aristotle, passing through Boerhaave and Haller up to Barthez, each has given his explanation of it. Barthez's theory seems to be the best. At the moment a person is about to leap he bends the joints of his lower limbs, and maintains such flexion by contracting his muscles. Before the straightening of the body that precedes the leap, the body braces against the earth with one foot bent obliquely; the leg bends over the foot, the thigh over the leg, and the trunk over the thighs. The body is shortened and the center of gravity lowered. The flexor muscles diminish their action, and the extensors, entering into play, give the bones of the lower extremities an upward motion. At the same time that the extensors of the lower extremities are straightening the leg and thigh, the extensors of the vertebral column are rendering the same office to that (Fig. 1). The upper extremities act then as balances or as wings. The arms carry the body along so well that it is necessary to take care to double up the fists in order to increase their weight (Fig. 2), after the manner of the ancients, who, in order to pass over a greater space, held dumb-bells in their hands when they leaped.

In the practice of leaping, care should be taken not to attempt excessive leaps regardless of the hour of the day or the weather. The bodily condition varies, and a person who to-day should leap a distance of six yards, might to-morrow injure himself in leaping but two, on account of being in poor condition. Cold renders the bones brittle, and high leaping in cold weather is always more dangerous than in warm.

We cannot enumerate in this place the names of all the celebrated leapers, but we may cite a few examples of leaps famous for their length.

The Grecian athletes, according to Abbot Barthelemy, leaped a distance of no less than sixteen yards, a fact that proves that we have degenerated, for a leap of six yards without a springboard is now not usual, and necessitates a strong effort. There is cited the case of a fireman named Semson, who, at the burning of the Franconi Circus in 1826, leaped from a window 39 feet above ground. This leap was made backward in holding on to the window by the arms. As he jumped according to the correct principles that he had been taught, this man received no harm.

We do not wish to dwell here upon the leaps that are made in circuses and hippodromes by means of accessories that, on the one hand, diminish their danger, and, on the other, increase their length, since such leaps are not made during the ordinary course of life. Yet we advise those who desire to leap well to practice with the springboard. They will derive the greatest advantage from this exercise, especially if they practice somersaults thus. This sort of leap has the great advantage that it gives him who often executes it as an exercise an imperturbable confidence and a skill that can scarcely be acquired by any other means. A man accustomed to turn somersaults never loses his head on any occasion, and, if he happens to fall from the top of a carriage to the pavement, he does it with as much grace as if he were performing one of the most natural of acts.

The exercise of leaping with the pole is likewise a most useful one. The pole, in fact, allows one to leap to distances that could not be reached without its aid (Fig. 3). We find an old document that comes to the support of our assertion. A letter dated Lauffenbourg (Switzerland), Feb. 5, 1846, says: "We have just been witnesses of a leap that may be truly qualified as at once great and perilous, and the like of which the annals of gymnastics offer no example of. A student of the University of Tubingen, Mr. Goehlert, who was here last week, had bet with some of his friends that he would cross the Rhine at a single leap, and that he would thus pass from Switzerland to the Grand Duchy of Baden. Friday noon, Mr. Goehlert, provided with a long and heavy pole, and accompanied by a hundred young people, appeared in front of the Rheinstein, a rock which is situated at a little distance from our city, in the middle of the Rhine, and which was then high and dry on account of the low tide.

Fig. 3.—LEAPING WITH A POLE. (From an Instantaneous Photograph.)

Mr. Goehlert suddenly leaped toward the summit of the Rheinstein, and, resting his pole upon it, shot forward toward the opposite shore, where he landed safe and sound amid the plaudits of the curious."—*Science et Nature.*

Agriculture and Industries of Japan.

The Commissioners of Japan to the New Orleans Exposition have, with their catalogue, given some interesting descriptive notes on the agriculture, arts, and industry of that country. Perhaps the most striking statement in this monograph is that which introduces the mention of agriculture in Japan. We all know Japan is made up of a chain of volcanic mountains, which cover a large portion of the surface, but the entire arable land of the empire is officially put at only 11,215,000 acres—less than one-half the area of the State of New York—and this is so fertile and thoroughly cultivated that it feeds a population of 37,000,000—about that of France. Rice is one of the principal crops, and of this some 200,000,000 bushels are raised annually, but among other leading products are wheat, barley, beans, potatoes, sugar cane, and cotton, and nearly all agricultural work is denominated "spade husbandry," from the fact that hand labor is generally used, to raise large crops and keep the land in the finest condition, two or three crops a year being raised on the same land. Artificial irrigation is general, being necessary over more than one-half of the cultivable area, and it is frequently the case that the water is taken from streams from twenty to thirty miles distant. Steam plows and reaping machines naturally find little room for employment here, and all agricultural implements are of the most primitive forms. The total number of horned cattle is 1,115,000, and of horses 1,605,000. Wood of all kinds is cheap and abundant, nearly all the buildings being of timber, and wood constituting the principal fuel; the area of forest land is nearly three times as great as that under cultivation.

Japanese industries, although in many cases their origin may be traced back to China and Corea, have changed somewhat in recent years, but they have not yet been sufficiently developed to be carried on as a rule in what we call manufacturing establishments. They are mostly conducted in small workshops, with possibly the aid of a primitive water wheel, fan making, and the manufacture of porcelain, paper, pigments and lacquers, constituting a large portion of the whole. Nearly all kinds of ores and minerals are abundant in Japan, but mining and metallurgy, although practiced to some extent for centuries, do not take the prominence that would be expected, when we remember that some of the most exquisite specimens of hammered iron and bronze work to be found in important collections to-day are the productions of Japanese artisans of a thousand years ago. The government, however, is extending aid to these and to many other industries, in a spirit as intelligent as it is liberal, good evidences of which are to be seen in the extensive display made by Japan at New Orleans.

Hearing the Earth's Magnetic Induction.

Dr. Schaper recently demonstrated to an audience the magnetic induction exercised by the earth. A number of telephones were arranged in series upon one circuit, which was rapidly made and broken by an interrupter. A telephone was then repeatedly turned end for end in such a way that its north and south poles were alternately the uppermost, and at each reversal a crack was heard in all the telephones, resulting from the induction of the earth on the central magnet. If the experiment be made with an induction bobbin, only the crack is extremely feeble, due in that case to the induction of the earth on the bobbin. The telephone may be replaced by a magnet wrapped with insulated wire. The degree of sensibility of the telephones can be determined, if the axis of rotation of the magnet employed in the experiment be brought little by little nearer to that of the inclining apparatus.

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Feather Fur.

Fur made from feathers has been used for five or six years for the borders of ladies' cloaks and dresses; muffs, capes, bonnets, etc., are made of it; even sealskin cloaks have been imitated in this material. The article is almost as suitable for this purpose, and sometimes more so than real fur; its principal advantage is that it forms an even surface which may be torn into suitably small strips without loss of substance, while in the case of real fur the breast, back, and every other part of the animal has different qualities; another advantage is that it is light, pliant, and apparently insensible to pressure and blows; and lastly, it may be moistened and even treated with hot water without its solidity being altered.

Other stuffs of a similar appearance have been made and used which, however, have this in common with each other, that the quills of the feathers are sewn in a more or less primitive way on to a lining or woven into one. The quill must naturally make the fur stiff and full of breaks; and, therefore, spoils the appearance of the flowing folds of a lady's cloak. In the material we are describing the fiber is detached from the quills and fastened to a lining, so that the fur retains the whole of the pliancy of the material chosen for the lining.

The process of the improved manufacture is as follows: Long blocks are formed of pieces of cardboard, which are placed parallel to each other, and between these stalks of feathers are put in such a way that only ⅛ to ¼ of an inch of them projects over the upper edge of the cardboards; the surface, consisting in reality of these feather tops, is then covered with an India rubber solution, after which a tissue, over which also rubber solution has been spread, is stretched over it, brushed, and rolled. If then the pieces of cardboard be taken out, the result will be that the fibers will adhere to the lining, and form a fur.

As to the details of the manufacture, the comb is the most important of the tools used. It consists of a piece of hardened steel, the front edge of which is provided with fine wire teeth perpendicular to it. The feathers to be used are placed near each other along the whole length of the comb in such a way that the quill lies behind the teeth, and one-half of the soft part of the feather hangs out of the comb. When the latter is filled with feathers lying near each other, the part of them which hangs out forms a continuous fringe, which is now ready for laying between the pieces of cardboard. For this purpose the pieces of cardboard are placed on a frame inclined at an angle of 45°, and are pressed together in it by a sledge sliding on rollers, which carries on its front an edge parallel to the cardboards. On the planed sides of the frame slides a second sledge, which carries two open angle bearings. The comb is laid with its pivots on these angle bearings, so that the stalks of the feathers hang down behind the last piece of cardboard; then by means of a treading arrangement the sledge is raised, another piece of cardboard put behind the fringe, and the sledge again let down. If now the comb, which swivels round its pivots, is let down at an angle of 180°, the stalks held fast by the sledge are stretched so tightly round the edge and front of the comb that it is quite easy to separate them from the comb by cutting them; the front edge of the comb has a groove in it which serves as a guide to the knife when cutting. This operation is continued until the whole frame, which holds a block of about 12 inches thick, is filled with alternate rows of feather fibers and sheets of cardboard. The block on which this work is carried on is in the middle of a table, at which eight other girls are working besides the one attending to the block; these eight have to attend to the filling of the combs, and together with the former form a column.

When the frame is full it is locked tightly, so as to be portable, and then taken to another part of the manufactory, where the blocks are joined to longer tables. The latter are then put on a wagon and taken to the drying room to be covered with a solution of rubber in naphtha, which is spread over the whole length of the table by means of a knife.

After that the solution is dried, the naphtha being removed before the India rubber cloth is put on. The drying apparatus, into which the table with the cardboard is put, is a long box open at the front; on the bottom are the rails on to which the tables are placed. A system of steam pipes is situated near the top, under which the part which has been covered with India rubber is placed at a short distance. The back part is perforated, and forms the communication between the box and a flue behind it leading to an exhauster, which sucks up the evaporated naphtha, and in this way hastens the drying process. When the coating has been dried, which will take from 18 to 20 minutes, the plate is taken out and a tissue spread over with rubber solution stretched over it; the whole is then brushed and rolled in a mangle weighted with about 3 cwt., until both rubber surfaces are completely joined. Finally the table is turned round to take the cardboard out, which operation must be performed with special care. At the beginning of the manufacture it was found that the stuff had a kind of grain, *i. e.*, that the fibers, while they should stand perpendicular to the lining, inclined to one or the other, or even several directions from the perpendicular, and that this oblique position was not to be remedied by any mechanical means; this grain was merely the consequence of the way in which the cardboard was taken out. A small ridge, which, while the pieces of cardboard are being turned round their basis, assumes a particular inclination, is formed at the place where one piece of cardboard touches another. As the feathers are embedded in these ridges, the turning of the pieces of cardboard causes this oblique position of the feather stalks. It is therefore a matter of importance that the cardboard should be taken off in a perpendicular direction to the lining. To do this the long blocks of cardboard are stretched over tables whose surface forms a section of a circle, the pieces of cardboard are taken hold of singly with fine pliers and only pulled to one side just far enough to loosen the rubber, but remain in their place until they are taken away together, and therefore serve as a guide until they are placed perpendicularly. When the whole block is loosened, the pieces of cardboard are lifted off to clean and steam the now finished piece, the steaming being done to restore to the feathers their elasticity, which was partly lost by the dyeing process.—*Tex. Manuf.*

Fatal Leap from the East River Bridge.

Since the famous leap of 125 feet by Sam Patch, at Genesee Falls, in 1828, no other so desperate feat of that kind has been attempted until that of May 19, when Robert E. Odlum jumped to his death from the New York and Brooklyn Bridge. The details connected with the first incident have had an attraction for the curious the world over ever since—the daring exploits of its principal before that last fatal attempt, and the explanation that intoxication was the most probable reason for its then causing his immediate death. In the case of Odlum there was no charge of this kind. He was a tall, athletic young man, an expert swimmer, which he had taught as a profession, and had come on from Washington three days previously expressly to make this leap from the bridge; he had before performed similar feats, though with the distance not so great, and seemed to have no apprehension of any serious result to himself. The police endeavored to prevent him from accomplishing his object, and their watchfulness made postponement necessary, but Odlum succeeded in eluding their watchfulness, and made the leap, at a point about 200 feet from the New York pier, and 140 feet above the water.

He held his right hand high above his head, and seemed to go down straight as a spear for nearly the whole distance, but, about forty feet from the water, his head and body appeared to bend backward, and to the left, and he struck the water with a great splash. The body was out of sight but a moment, when it was taken into a boat, and consciousness, after hard work, was restored for a moment. The doctor's report was that the injuries were such as would be found in a man crushed to death by the caving in of a sand bank; the internal organs were so pressed together as to rupture the left lung, liver, spleen, and kidneys, while five of the ribs were fractured on the left side, the first high up on the chest and the others irregularly down the side and back, although his spine was not broken.

It is reported that the time occupied in the descent was 3¼ seconds, which is very close to what it should have been theoretically. The distance through which a body falls the first second is very nearly 16 feet, and the distances for equal consecutive times are as 1, 3, 5, 7, etc., which would give for three seconds $16 + 48 + 80 = 144$ feet, the figures varying slightly, according to the resistance of the air. The velocity which the body had attained at the end of the third second was 96 feet per second, and, its weight being 175 pounds, the force of striking would be $96 \times 96 = 9{,}216 \div 64 = 144 \times 175 = 25{,}200$ pounds. The only theory on which it is maintained that such a jump could be safely made is that the body may be held perfectly perpendicular, with the toes so bent down that the body will enter the water as a wedge, and thus distribute the impact over a large surface, operating through a longer time, until the downward momentum is overcome. In this instance, from the way in which the body struck the water, it is impossible to say how great a surface was exposed to the principal force of the blow at the moment of impact, but the body itself barely went under water, and so received the direct blow with a force quite sufficient to explain the doctor's statement that "Odlum was simply mangled to death."

This trial also points out the difficulty of maintaining the body in such equilibrium as could alone afford any possibility of success; the principal weight being in the trunk, the natural tendency would be for the body, were it a rigid, inert mass, to turn over, and descend head first. Odlum seems to have had some conception of this, from his holding his right arm straight up, but this did not prevent his body from partly turning over before it struck the water, a movement which he in vain attempted to check.

It is to be hoped that the fatal results of this last bid for notoriety will effectually put a stop to such attempts for a good while to come. Its success could hardly have been other than accidental, and in that case no one knows how many lives would have been ultimately lost by the foolhardiness of would be imitators.

Choice of Occupation.

Much is said in "writings for youth" as to the importance of choosing such an occupation for life as nature's inclinations appear to favor; and in some instances resort has been made to professional head and face readers to indicate the line to which the unformed mind should be directed. But it is often the fact that even a thinking and sensible boy is unaware of any decisive "call" to a particular pursuit. Much of this indecision probably comes from the fact that the call for a choice occurs at about the time in years and development when the subject is unfitted to make a choice—"not a man, nor a boy, but a hobbledehoy," as an old saw has it.

It is foolish to "strike out," "map out," or "arrange" for a boy's future calling by means of his expressed desire at the callow age; the boy will naturally gravitate to his proper line—if the circumstances do not hinder—if those who have to deal with him do not interfere. It is not difficult to ascertain if there is a "bent" in the boy's inclination. If it is decided, then the influences and circumstances should be brought to bear in that direction. But it is best to start. Many make mistakes because they did not understand, and sometimes these early mistakes extend through the lifetime; but Burritt was a fair blacksmith, Collyer was a good one, Lincoln was a good rail splitter, and Johnson was a good tailor. It would be assumptive to say that the course of these men would have been better if at the beginning they had become linguists, preachers, statesmen, and presidents. Perhaps it was better that they were what they were at the beginning.

A friend of ours was to be an artist—if he could have governed circumstances; he became a machinist and mechanical engineer because it was in his way. Certainly he has done more useful work as a mechanic than he ever could have done as an artist.

If there is any moral to facts, as to fables, it might be that the best thing an ambitious young man can do is to do the first thing that comes to him, the first thing he can reach by going for it, and watch and wait opportunities for better things.

The Unhealthfulness of Large Apartment Houses.

Dr. E. G. Loring, of Madison Avenue, New York, who lives opposite an enormous apartment house, is reported as saying in a recent interview: "When I first took this house, that corner was occupied by a row of ordinary brown stone houses, one of which still remains. As you can see, the apartment house is more than double the height of the old houses, the last remaining of which now looks like a little child by the side of the Chinese giant. Before that place was built, I had the sun shining into my reception room from 9 in the morning until 12 or even 1 o'clock. Now my reception room gets no sunlight at all, while this room in which we are, and which is directly over the reception room, has sun for a few minutes only. The change in the atmosphere of the house is perceptible. My bedroom, which is in front, strikes a chill into me as soon as I enter it, and I am going to change to the back of the house, which has a northern aspect. It used to be the cold side of the house, now it is the warm. My light is seriously interfered with, and I have had to rearrange my office on that account. Then look at that street. As you see, this side, which never sees the sun, is damp and muddy. The opposite side is nearly dry. It is absolutely essential, in order to get rid of the microbes and germiniferous matter which are to be found in the damp streets of a city, that the sunlight should strike the gutters for some hours during the day. It is just as essential that the living and sleeping rooms of human beings should receive the direct rays of the sun. As to the interior sanitary condition of these apartment houses, I have no statistics which will enable me to speak positively. The massing together of so many families in itself tends to promote disease, while the multiplication of drainage pipes and plumbing affords yet another foothold for disease. Among my own patients I know of some who suffer from the wholesale system of heating. Even if they shut off the steam, the presence of such immense steam ducts in the walls renders their rooms unhealthily hot, and they have to pull the beds into the middle of the room before they can hope to sleep.

A Warning to Drinkers.

Le Journal d'Hygiene publishes a comparative table of the probabilities of life for moderate drinkers and total abstainers. According to this, a moderate drinker at twenty years of age may expect to live 15·6 years; at thirty, 13; at forty, 11·6; at fifty, 10·8; at sixty, 8·9. The probability for total abstainers is: At twenty years, 44·2; at thirty, 36·5; at forty, 28·8; at fifty, 21·25; and at sixty, 15·285.

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ENGINEERING INVENTIONS.

A car axle has been patented by Mr. George W. Bedbury, of Portland, Oregon. This invention relates to divided car axles, and consists in a novel construction of the hub for connecting and holding the ends of the two axles, the hub having also an oil groove recess and radial oil holes.

A car coupling has been patented by Mr. A. Judson Chapel, of Arkansas City, Kansas. This invention covers an improvement on a former patented invention of the same inventor, being more particularly adapted for triple headed couplers, and the coupling pins being designed to operate automatically for coupling cars provided with the ordinary slot link.

A car truck has been patented by Mr. John McEwen, of New York city. The object is to promote simplicity of construction and durability of railway car trucks, the peculiar arrangement of springs not only carrying the downward pressure, but at the same time holding the top frame from forward, backward, and lateral movement, and causing the frame to move up and down vertically.

A rotary excavator for removing snow, etc., has been patented by Mr. Edward Leslie, of Orangeville, Ont., Canada. It is designed for removing snow from railwaytracks, or make sand and earth cuts, having a revolving head in the form of a wheel or disk, fitted with radial cutting heads that are reversible, and with this revolving head is combined a fan wheel, to discharge material at the side of the track.

The propulsion of vessels forms the subject of a patent issued to Mr. Daniel S. Troy, of Montgomery, Ala. This invention covers a novel construction of air reservoirs in the hull of a vessel, and in air tubes between the inner and outer walls of the hull, for the use of compressed air for propulsion, through an engine, the reservoirs of the vessel to be charged from an air compressing apparatus at any convenient shore station.

A locomotive driving box has been patented by Mr. William J. Healy, of Susquehanna, Pa. This invention covers a box made with grooves on its sides for wedges, to keep it in place, with a cellar of such construction that it can be inserted in the open bottom without planing or finishing, but will be especially firm and adapted to receive the oil and cotton waste used to keep the driving wheel journal lubricated.

A compressed air and gas locomotive engine has been patented by Mr. Daniel S. Troy, of Montgomery, Ala. In place of the boilers usually employed in locomotives, a strong cylindrical vessel with double walls rests longitudinally upon the frame, the vessel being divided into two compartments for holding compressed air and compressed gas; there are devices for controlling the admission of air and gas to the cylinders, regulating the amount of expansion and time of explosion, and numerous details of construction intended to render the machine a practical working motor.

A gas engine has been patented by Mr. Daniel S. Troy, of Montgomery, Ala. It has two cylinders, each with separate piston connected with the same crank shaft, and after the compressed gas is expanded in one cylinder it is mixed with air and conducted to the second cylinder, in which the mixture is exploded, thereby driving the piston forward, the piston in the other cylinder being driven forward by the expansion of the compressed gas, there being a mixing chamber in which the gas and air are mixed, an automatic valve for admitting the mixture, and an automatic spark producing device.

A combined steam and hot air engine has been patented by Mr. David Lyle, of Manchester, Jamaica, West Indies. This invention covers numerous peculiarities of construction and arrangement providing that the steam and hot air are produced by one fireplace, and the exhaust steam and hot air serve to heat the feed water and the air to be used in the engine; the two cylinders are single acting, and each moves in opposite directions; the diameter of the steam cylinder is much smaller than that of the hot air cylinder, and the pistons are carried upward by the impetus of the driving shaft, while there is a valve cylinder between the hot air cylinder and the steam cylinder.

MECHANICAL INVENTIONS.

A mortising and boring machine has been patented by Mr. Edmond N. Camp, of Puckett, Ga. This invention covers a novel arrangement of two or more boring and mortising mandrels on reciprocating carriages, adapted for making a series of mortises or boring a series of holes at any predetermined place, and particularly for doing the same in curved bars of wood, as in the back parts of chairs, etc.

AGRICULTURAL INVENTIONS.

A hay stacker has been patented by Mr. Thomas S. Adkins, of Fredonia, Kan. This invention covers a novel construction of base frame, standards, inclined hinged platform, pulleys, rake, back frame, and other novel features, whereby a loaded rake can be readily elevated and its load dumped upon a stack.

A hay ricking device has been patented by Mr. Rees O. Davis, of Milan, Mo. This invention covers improvements on two former patented inventions of the same inventor, the balancing ropes being so connected with the rack, inclined top bar, and weight, by means of pulleys, that the rack will be balanced through all parts of its movement.

A thrashing machine has been patented by Mr. Martin Williams, of St. Johnsville, N. Y. The machine is in general of the usual character, but the straw is made to pass from the thrashing cylinder upon a grate of tines, where arms or beaters raise and toss it while moving backward, the movement being assisted by an ordinary beater above, these operations thoroughly opening the straw for the ready separation of the grain.

MISCELLANEOUS INVENTIONS.

A water wheel has been patented by William W. Dunn, of Fort Worth, Tex. This invention provides a good and simple form of water wheel, but its construction is of iron, and it is made in sections which may be readily taken apart for transportation.

An extension table has been patented by Mr. George McLagan, of Stratford, Ont., Canada. This invention combines a pawl and ratchet, pulleys, and sliding bars, etc., with novel features of construction, to facilitate the lengthening and shortening of extension tables.

A self-inking pocket stamp has been patented by Mr. Edwin M. Richford, of 44 Snowhill, London, Eng. This invention relates to the construction of the folding frame or holder in which the die and inking pad are contained, whereby a better impression may be obtained than with other self-inking pocket stamps.

A stove board has been patented by Mr. William P. Cole, of Montreal, Canada. This invention provides for a stove board with an upper external layer of asbestos, and a board or frame with an intermediate layer of woven fabric, edge binders, and corner caps, the object being to protect floors and carpets.

A bag holder has been patented by Mr. Martin Williams, of St. Johnsville, N. Y. It is intended specially as a convenient attachment for thrashing machines, to hold the bags that receive the grain from the screens, a stretcher with two arms attached to a bracket, making a device which can be readily applied and removed, and conveniently adjusted at the desired height.

A suspender buckle has been patented by Mr. Frederick B. Spooner, of Brooklyn, N. Y. This invention consists in the combination, with a plate having lugs on its back, of a latch plate pivoted on the said plate and resting on the lugs, to facilitate detaching the buckle of a suspender from the ring on the suspender end.

An earth and coal loader has been patented by Mr. Daniel J. Gilchrist, of Newark, N. J. This invention covers a combination of swinging and sliding bars with a scoop held to the same, ropes and pulleys for moving the scoop in the direction of the length of the bars into a heap of coal or earth, and ropes and pulleys for raising the scoop.

A fence post has been patented by Messrs. Milton Foreman and Samuel E. Foreman, of Randolph, Kansas. Combined with a fence post are rings thereon, each ring having two lugs at right angles to each other for holding the fence and brace wires, the object being to facilitate making a simple, strong, and durable wire fence.

A combination tool has been patented by Mr. Adon D. Crosby, of Cuba, N. Y. It comprises two limbs, one having a screw driver at one end, a tack claw and a wrench jaw at the other end, serrated surfaces upon opposite edges, a hammer head, etc., making a convenient tool for working on machinery, wagons, and for various other purposes.

A float valve for water closets has been patented by Mr. August F. Blesch, of Columbus, Ohio. This invention covers a peculiar construction and arrangement of parts whereby the float lifts the valve to its seat easily, positively, and noiselessly, without thumping or water hammer, and the device is also applicable as a ball valve for water tanks.

A corset steel fastening has been patented by Messrs. David Alcorn, Jr., and Robert A. Blake, of New York city. Hook plates are combined with and pivoted to the eye plates, with lips for engaging the upper edges of the eye plates, to limit their downward movement, and prevent corset steels from becoming accidentally disconnected.

A level has been patented by Messrs. James Walsh, Thomas F. Murphy, and Everett A. Clark, of North Adams, Mass. Combined with a hand and dial, a pivot is secured to a float resting upon mercury, so the mercury will cause the hand to turn more or less as the level is inclined, making an improved level which can also be used as an inclinometer.

An automatic vehicle brake has been patented by Mr. Richard R. Pace, of Lineville, Ala. It is so devised that when the horses pull on the chains or straps they pull the outer ends of levers to keep the brake shoes from the wheels, but when the horses hold back, as in going down hill, they so operate the levers as to press the brake shoes against the wheels.

A food steamer has been patented by Olive Nelson, of Houghton Lake, Mich. It consists of a box with vertical partition, perforated transverse portion, and perforated bottom, with doors and a flange on the under side of the box, and a removable water vessel into which the flange fits, being especially adapted for steaming meat and vegetables.

A garment hook has been patented by Mr George R. Grimes, of Terre Haute, Ind. It is formed of an arm from which a series of hooks project downward, on the prong of each of which hooks a curved transverse piece is held, on which the garments are hung, the device being adapted to hold a number of garments, and also tags bearing the numbers of arms and hooks.

A shoe has been patented by Mr. William D. Hall, of Beloit, Wis. This invention covers a congress gaiter with its front and back extended upward, flaps formed on or secured to the front extension with their lower edges disconnected from the gaiter or its gore, and a fastening for securing the rear edges of the flaps, the object being to provide means for holding the top of the shoe snugly against the leg.

An ale and beer pump has been patented by Mr. Edward Schlimbach, of Long Island City, N. Y. With the pump discharge pipe is connected a cylinder with a valve, the stem of which is connected with the pump lever by a lever and connecting rod, so the valve will be opened and closed by operating the pump lever, the object being also to promote convenience and reliability in packing piston rods and valve stems.

A sleeping car seat has been patented by Mr. Alexander L. Kean, of Elizabeth, N. J. The seat is held to slide on a frame pivoted on a base on the floor, and combined with the seat is a board held to slide on the back in the direction of its length, a back rest hinged to the upper end of the board, and means for holding the back vertically on the board, making a seat which can be easily converted into a bed.

A spring brace for vehicles has been patented by Mr. Edwin J. Strong, of Beresford, Dakota Ter. The braces are hinged together at a point centrally between hinge eyes fixed on the body of the vehicle and upon the gear which supports the springs, to relieve the springs of the carriage from the strain consequent to endwise motion, and too much upward motion of the carriage body relative to the supporting gear.

A sash fastener has been patented by Mr. James Walsh, of North Adams, Mass. Combined with a vertically swinging sash lift or handle provided with cams are sash locking rods extending from the handle to the side edges of the sash, heads secured on the rods being adapted to be acted on by the cams, making an improved handle for raising and lowering sashes as well as a sash lock.

A roller roughing machine has been patented by Mr. Archibald Mitchell, of New Orleans, La. This invention covers a hardened steel milling tool and a mechanism for pressing it against the surface of a canemill roller while being revolved, to roughen the surface of roller so they will bite and hold the cane, thus drawing it in more effectually than can be the case when the rollers are worn smooth by the cane.

A holder for ornamental and fly paper has been patented by Mr. Vurlin G. Tansey, of Ashland, Neb. This invention consists of a frame formed of a series of spokes secured to a central plate, and having their ends united by a ring to hold paper on the ceiling of a room, at the middle or corners, so as not to deface the ceiling, and allow the paper to be conveniently arranged.

An improved beehive has been patented by Mr. Henry S. Gideon, of Crescent City, Iowa. This invention consists in the peculiar construction and arrangement of parts, which is such that side boxes can be opened at any time to take out honey, or the side and front entrances so closed as to secure the honey from mice and insects, with other novel features promoting the healthfulness of the bees.

A sheet metal vessel has been patented by Mr. Isaac S. Lauback, of Boston, Mass. This invention relates to securing bottoms on such vessels, and consists principally in forming the bottom integral with the flange that supports the base, and securing the bottom to the open end of the body by a lap or folded joint that clinches the body and bottom together.

A wind wheel has been patented by Mr. Jarvis M. Flint, of Thayer, Kan. This invention covers a peculiar construction and arrangement of parts for an easy running wind mill, the wings being automatically so changed during a strong wind that they will offer less surface and a greater angle to the wind, so that the machine will then run as slow and steady as in a light wind.

Refrigerator barrels and other like receptacles form the subject of a patent issued to Mr. James W. Weston, of New York city. This invention covers an internal structure, with uprights and diaphragms, to make a series of compartments for holding separate articles, so the sizes of the compartments may be varied, and so there may be a central tube for holding ice for cooling.

A bridge indicator for billiard tables has been patented by Mr. Charles F. Spaulding, of Elizabeth, N. J. Sliding bars, hooks, and a connecting mechanism are so arranged that the weight of a bridge handle is made to raise the ends of the bars slightly like little buttons above the tops of the rails, and thus indicate where the bridges are without the player taking his eyes off the table.

Watchmakers' pliers form the subject of a patent issued to Mr. Henry A. R. Horton, of Cleburne, Tex. This invention more especially consists in a certain construction of the jaw end portions of the pliers, whereby the utility of the implement will be improved for removing the hands from a watch or for holding new hands when they are to be filed and otherwise fitted.

A baby carriage has been patented by Messrs. Harry M. Ribble and John W. Sammis, of Dover, N. J. This invention is designed to facilitate turning and steering the carriage, an arm projecting rearwardly from the pivoted front axle, and a bent rod connecting the arm to the handle, the rod and arm being so arranged that the front axle can be turned more or less thereby.

A bottle stopper has been patented by Mr. William Beardley, of Beacon, Iowa. With an apertured cap fitted upon the bottle neck is an apertured packing interposed directly between the cap and the upper edge of the bottle neck, having upon its inner surface, around its aperture, a flange and ball valve, making an improved stopper for bottles containing soda water or other aerated liquids.

A combined fire box, grate, and sifter for stoves has been patented by Mr. Isaac J. Wells, of Nanuet, N. Y. The grate bars have their rear parts extended upward and in contact, and are held in place by a hooked plate forming the rear wall of the fire box, there being a bar with alternating lugs for agitating the grate bars, while beneath the bars is placed a sifter to be jarred by the movements of the grate bars.

A mechanical and electrical alarm clock has been patented by Messrs. Isaac S. Moser and Francis Magee, of New York city. With a mechanical alarm clock this invention combines tongues connected with electric circuit wires, and a circuit closing piece on the end of the spring for releasing the alarm mechanism, so that when the circuit is closed an electrical bell is sounded until the circuit is broken.

A screw threading machine has been patented by Mr. Charles E. Coe, of Leesburg, Kansas. This invention covers a specially constructed machine for turning metals, intended to turn and square up shoulders and to cut new screw threads by hand to supply the place of old ones which have become worn in use, and particularly for forming new screw heads on carriage axles, and to extend the screw head on pipes, bolts, etc.

An electric glass cutting machine has been patented by Messrs. Philipp Lange and Ernest Lindner, of New York city. Combined with a stand suitably arranged for holding the article to be cut is an electric generator, which may be so connected with a platinum wire adjustably maintained on the surface of the glass that the platinum wire will be made red hot, thus heating the glass on the line of desired fracture, after which the glass is plunged into cold water, causing the separation.

A velocipede has been patented by Mr. Daniel S. Troy, of Montgomery, Ala. This invention covers a velocipede propelled by a motor operated by the explosion of compressed gas and air; it has a light and very strong metal frame in which are carried three cylindrical receptacles for the compressed gas, an explosion cylinder with valves for regulating admission of compressed gas and air, and other novel features, to form a vehicle which will travel rapidly and can be easily steered.

A combined shutter and diaphragm for photographic cameras has been patented by Mr. DeWitt C. Hoover, of Buffalo, N. Y. Two shutters are fitted to slide one on the other in opposite directions, operated by toggle bars and springs, adjustable so that the openings shall coincide to a greater or less extent, with means for holding the shutters fixed, thus providing cameras with shutters for instantaneous work, while they may be also arranged to serve as adjustable diaphragms to form a permanent attachment to the lens tube.

NEW BOOKS AND PUBLICATIONS.

TENANTS OF AN OLD FARM. Leaves from the Note-Book of a Naturalist. By Henry C. McCook, D.D. New York: Fords, Howard & Hulbert, 1885.

Dr. McCook has gained for himself a very enviable position among entomologists; by his careful and diligent study of insect life, particularly of ants and spiders, he has become a recognized authority on these subjects. His previous works, and especially his account of the agricultural ants of Texas, excited so much interest that the present book has raised large expectations. The "Tenants" is a simple and pleasant account of how a naturalist spent a year in search of health among the fields and meadows of an old farm near Philadelphia, and of how his search was rewarded not only with its object, but with much else in addition. The narrative form makes the book more attractive to young people, who will, as a rule, swallow a large amount of information if it be properly baited with a story, though the assimilation under these circumstances is still an open question. To the general reader, however, we think that the book would be much more acceptable, could it be filtered of some of its long conversations, and could the highly interesting facts they contain be separated from the very mild form of fiction diluting them, and be gathered into short, straightforward sketches of nature. There are several characters introduced, and even a couple of lovers, but it is the naturalist always who speaks, and one's attention is somewhat distracted by the ingenuity shown in framing the questions assigned them to bring forth the fullest answers. But it is withal a deeply engaging book, and the charming accounts of moths, bees, ants, spiders, and other native-born tenants of the old farm will clothe the humble members of the insect world with a new interest. The illustrations, taken largely from nature, are admirable from their clearness, and often from their humor and artistic merit.

A TREATISE ON FRICTION AND LOST WORK IN MACHINERY AND MILL-WORK. By Robert H. Thurston. New York: John Wiley & Sons, 1885.

The subject of friction losses, which is usually treated rather incidentally in works on mechanism, has been elaborated by Prof. Thurston into an interesting and exhaustive volume. It is intended, as stated in the preface, to be used either as a text-book or as a work of reference. Since in all properly designed machinery friction is the only cause of lost work, the consideration of the laws of its generation and prevention is second in importance only to the study of pure mechanics. The contents of the work are drawn largely from the author's personal experience, and will have an additional value on this account. They contribute a considerable amount of new information, and detract somewhat from our old store by showing the unreliability of certain laws and values hitherto accepted in practice. In the logical development of the subject the general action and efficiency of machinery form a very suitable introduction. The laws and theory of friction are naturally discussed at some length. The different kinds of lubricants and the apparatus for their application are fully described, and are followed by practical methods for the chemical and physical tests of oils. The quantitative determination of friction is developed under testing machines, and the theoretical consideration of the coefficient of friction. The final chapter, on the finance of lost work of friction, sums up the practical results of the book. The conclusions reached will be of true value to the manufacturer and engineer.

PHOTO-MICROGRAPHY, including a description of the Wet Collodion and Gelatino-Bromide Processes, etc. By A. Cowley Malley. London: H. K. Lewis, 1885.

Within the past few years Science has brought a great many agents into her active service, but none, perhaps, have better vindicated the wisdom of her choice than the microscope and the camera. Of late, they have been used in combination, and photo-micrography has become an acknowledged and valuable means of investigation. It has already accomplished much, and promises more for the future. Mr. Malley's book gives a brief description of the instruments employed, and an outline of the best methods for preparing the sections and attaining a clear, sharp impression. Though it is far from exhaustive, it has the merit of being practical, and contains many useful hints which will save the experimenter much time and labor.

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Curtis Pressure Regulator and Steam Trap. See p. 285.

Woodwork'g Mach'y, Rollstone Mach. Co. Adv., p. 284.

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Barrel, Keg, Hogshead, StaveMach'y. See adv. p. 270.

Wanted.—Patented articles or hardware specialties to manufacture on contract or to manufacture and place on the market. First-class facilities. Correspondence solicited. Address Hull Vapor Stove Co., Cleveland, Ohio.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 334.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) M. H. asks: 1. What wire gauge is used in measuring wire for induction described in SUPPLEMENT, No. 160? A. American. 2. By using 28 wire in said coil, will it do to light gas? A. Yes. 3. How are the medical coils made? A. Like the one described in the SUPPLEMENT, but without a condenser.

(2) C. S.—We know of no means of increasing the volume of sound in the Bell telephone receiver, but by using two receivers, one at each ear, the combined effect of the two is very much greater than that of a single receiver.

(3) E. A. R. wants some simple way in which to produce the gas and inflate toy balloons, so they will float in the air when released. A. You can make hydrogen gas for this purpose by pouring slightly diluted hydrochloric acid on an equal weight of zinc in a covered vessel having a small stop cock in the top for filling the balloon. Ordinarily, we believe, it is found to be more convenient to use the common illuminating gas, and the balloons can thus be directly filled from the gas jet.

(4) L. C. L. asks: 1. Are porpoises used for anything except oil? A. Besides the oil, the skin is of value for leather, and the flesh is eaten. It is said that a company has been organized for the purpose of using the flesh for mince meat. 2. By what kind of nets are they caught? A. The net is of loose mesh, and sometimes a seine as long as 1,000 yards is used, reaching to the bottom of the sea. 3. In your SCIENTIFIC AMERICAN of the 14th inst. you speak of turtle oil. Is there any established market for it, if so, what is its market value? A. Not in New York. 4. How is it prepared, and how preserved? A. According to Spon, it is extracted from the eggs and fat of various species of turtle in Brazil and the South Pacific islands, and is used in food and medicine, and for lighting. We presume that it is only of local importance. 5. Is the shell of the green sea turtle of any value? A. No.

(5) H. A. U. writes: I have a very old violin, and the finish or varnish is all worn off. Can you tell me how to varnish and stain it so as not to injure its sound? A. Use coarsely powdered copal and glass, each 4 oz.; alcohol, 1 pint; camphor, ½ oz.; heat the mixture with frequent stirring in a water bath, so that the bubbles may be counted as they rise until solution is complete, and when cold decant the clear portion. Add a little dragon's blood to produce the reddish color.

(6) E. I. writes: Would like to know if you could give me some information regarding the preservation of shrimps for fishing purposes, for say two or three weeks, either alive or dead. One way to keep them alive, but only for two days, is to put them in loose sawdust. Have also tried putting the dead shrimps in salt in a glass which answered fairly, but there may be some better way to fix them? A. We know of no other methods than the one mentioned by you.

(7) G. F. B. writes: I have made a mixture of kerosene oil, camphor, and ammonia; what can I put into kill it the disagreeable smell? A. If the odor arises from the kerosene oil, the best thing to do is to use a better grade of the oil, and then it can be masked somewhat by using some strong aromatic, such as oil of cloves with perhaps a little oil of bergamot. A good quality of the kerosene should be almost entirely odorless. There is an aromatic ammonia described in the U. S. Dispensatory which, if desired, could be substituted for the plain article as used in the recipe as given by you.

(8) A. P.—You can get soda ash from any druggist by asking for sodium carbonate or sodii carbonas. Its preparation as well as that of caustic soda is complicated, and unless you have a supply of apparatus, you will find it more convenient to purchase it.—It is probably the following: Mix 8 oz. prepared chalk, 2 oz. turpentine, 1 oz. alcohol, 4 dr. spirits of camphor, and 2 dr. aqua ammonia. Apply this mixture to the article with a sponge, and allow to dry before polishing.

(9) F. K. says: In your Notes and Queries of April 25, J. H. asks what harmless preparation he can use for coating a wooden tank, to supply his house with water, to prevent the water from penetrating the wood. Let him paint it inside with melted paraffine applied *hot*, then burn in with a gasoline burning tool, such as painters use for burning off old paint; the heat will expand the pores of the wood, and the paraffine will enter, leaving the surface clean; care should be taken not to apply the heat too suddenly, as the paraffine will run down before the pores are sufficiently open.—F. K. asks: What can I use to coat Manila paper, by dipping, to make it impervious to moisture. It must be cheap, contain no poisonous ingredients, not crack, nor deface the paper. A. Paraffine or wax is commonly used.

(10) C. W. B. writes: Please give me a recipe for mixing kalsomine so that I can put on successive coats (without mixing with alum or any size) and not wash up. A. Kalsomine is composed of zinc white mixed with water and glue sizing. The surface to which it is applied must be clean and smooth. For ceilings mix ½ pound glue with 15 pounds zinc; for walls 1 pound glue with 15 pounds zinc. The glue, the night before its use, should be soaked in water, and liquefied in the morning. 2. Also, will you give me a recipe for making a gold size that will not lose its tack. A. Gold size is prepared by grinding calcined red ocher with the best and oldest drying oil, and mixing with it a little oil of turpentine when used. When the work is to be gilded, first give it a coat of parchment size; then apply the above size where requisite, either in patterns or letters, and let it remain till, by touching it with the finger, it feels just sticky; then apply the gold leaf, and daub it on with a piece of cotton; in about an hour wash off the superfluous gold with sponge and water, and, when dry, varnish it with copal varnish.

(11) W. B. C. writes: 1. Will a dynamo that can can be run with a spring or weight of 25 pounds supply one or two Edison lamps of 15 or 20 candle power each? A. It may be possible, but it is not practical. 2. Can I run an Edison lamp (15 candle power) with a battery? A. Yes, but it will take a large number of cells, and will be very expensive. 3. Can you tell me of any work on electricity that would explain constructing a dynamo, and the way electricity is used for a motive power? A. Consult Du Moncel on electric motors. See also back numbers of the SUPPLEMENT.

(12) E. B. writes: 1. Please explain how the sound wave is changed into an electric wave in telephoning. A. Sound waves are not changed into electric waves in the telephone. You will find a full explanation of the action of the telephone in the back numbers of the SUPPLEMENT. 2. If a steel magnet was wound with copper wire, and the ends of the wire continued to a short distance and wound round a soft iron bar, would the bar of soft iron become magnetic? A. No, that is, unless the magnetism of the magnet were in some way suddenly varied so as to set up an induced current in the wire. 3. Suppose an electro-magnet was brought to within a short distance of a piece of soft iron that was covered with copper, would the iron (the piece covered with copper) be attracted by the electro-magnet by induction? A. Yes. 4. And if so, would the iron after touching the electro-magnet adhere to the magnet, or would it be repelled? A. It would be attracted by the magnet. 5. Why are carbon rods used in the electric lamp, and why would not metal do as well? Would not the space between the wires be luminous if no electric lamp were used, but simply break the circuit? A. Carbon seems of all substances best adapted to arc lighting. All metals volatilize in the electric arc, and would therefore be speedily dissipated.

(13) W. E. D. desires the formula for an ink such as is used by penmen for engrossing, the quality most desired being absolute impermeability to light. The ink I refer to is intensely black, leaving the finest lines show very distinctly. A. Try the following:

Bruised galls	4 parts.
Gum	1 "
Iron sulphate	1 "
Soft water	45 "

Macerate for three weeks, employing frequent agitation.

(14) W. P. C. asks: Can a good oarsman row and make any headway against a current flowing at 6 miles per hour? A. An expert oarsman in a good boat can do this for a short distance.

(15) C. M. B. asks a way of ventilating a Mansard third story of a twin house to lessen the summer temperature. A. We know of no better way than to open vent holes at the base of the Mansard, and put a ventilator on the top, so as to allow a circulation of air between the roof and ceiling. Better consult with an architect or builder.

(16) G. B. writes: I saw recently an account of filings being made to resemble gold dust so closely as to be hardly distinguished from it. Will you in your next issue please inform me the materials used, and the way of using same? A. Such a process was used for the accomplishment of a fraud. We have no knowledge of the means used, but suppose that the filings were electroplated with gold.

(17) R. R. D.—Water deprived of air by boiling or any other means is a better conductor of heat or cold, and thereby allows the freezing process to take place quicker. It is also supposed that the air in water imposes a mechanical impediment to crystallization, as the act of freezing discharges the air from the water to a great extent.

(18) S. N. S. writes: In Philadelphia we are afflicted with bad water. Some are sinking wells. Are all impurities removed from water by boiling? A. The object in boiling water is to destroy any disease germs or microscopic life that would injure health. While it no doubt does have a beneficial effect, still we believe that recent investigations have shown that certain germs are capable of resisting the heat of boiling water. Well water in cities is unsafe for drinking purposes.

(19) J. T. McC. asks: 1. What would be the best material to mix with ordinary paraffine oil to stiffen it into grease? A. Paraffine wax. 2. How should it be properly mixed? A. Melt together and stir until cool. 3. Would you recommend strong lye as a part with other articles to bring it to a proper consistency? A. Lyes are without effect on paraffine. 4. Would you recommend paraffine tailings as a good and profitable article to mix with the above named oil? A. If for a lubricating compound, decidedly not.

(20) J. F. P. asks for the receipt of how to make the white powder used in making that effervescing summer drink called "sherbet," or "Persian sherbet." A. Take 8 ounces sodium carbonate, 6 ounces tartaric acid, 2 pounds finely powdered loaf sugar, 3 drachms essence of lemon. Let the powders be very dry. Mix them intimately, and keep them for use in a closely corked, wide mouthed bottle. Put two good sized teaspoonfuls into a tumbler; pour in ½ pint of cold water, stir briskly, and drink off. See also "Summer Beverages," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 192.

(21) L. H. R. asks how much power can be developed from a 20 and 30 foot overshot wheel with a 4 inch solid stream of water. A. For 20 feet fall, 9 horse power; for 30 feet fall, 13½ horse power.

(22) W. H. C., Leghorn, Italy, and others,—That the steamship Alaska was not provided with an eyebolt for chains on the outer edge of rudder is true; why, we do not understand.

(23) M. E. B. asks for the best way to prevent wrinkles in transferring photographs on concave glass. A. See elabcrate article on this subject, No. 8, vol. lii., page 120, SCIENTIFIC AMERICAN.

(24) E. S. G. asks what are "tatties" or "tatty," something cool houses, used in India. A "tatta" is a bamboo frame or trellis hung at a door or window of a house, over which water is suffered to trickle, with a view of cooling the air as it enters.

(25) C. T. McM. writes: I am unable to account for the accepted fact of the moon's presenting to the earth the same side always. Please give me the reason. A. We, as well as all of the rest of the world, are in the same fix. We have no knowledge of the revolutions of the satellites of other planets, so that we can draw no conclusions from comparison, but accept the fact.

(26) C. T. J. asks: What must be the dimensions of a steam engine to constitute one horse power? A. Cylinder 3 inches diameter, 4 inches stroke, at 60 pounds boiler pressure and 150 revolutions per minute. If less pressure or number of revolutions, use a larger cylinder in proportion.

(27) L. A. D. asks (1) how to remove the fatty matter which collects in the pores of the face, sometimes having a black spot on their top. A. See answer to query 8, in SCIENTIFIC AMERICAN for February 21, 1885. 2. What will remove freckles from the face? A. For freckles use a mixture consisting of 2 parts sulphocarbolate of zinc, 25 parts of distilled glycerine, 25 parts rose water, and 5 parts of scented alcohol, and it is to be applied twice daily for from half an hour to an hour, and then washed off with cold water.

(28) C. D. C. asks if there is any known solution for plating glass with nickel or copper. A. We do not believe that there is any solution that can be used to plate glass with either nickel or copper. The process of silvering the ordinary looking glass is with tin and mercury.

(29) W. P. S. writes: I wish to get some inexpensive motor to operate a fan to be placed on the front of a church organ, to render comfortable the work of the organist. I have an electric motor, but the price of that is too high. A. The best device for your purpose we think would be a small jet taken from the organ bellows, and employed on the ejector principle to furnish the current of air.

(30) J. S. B. asks whether there is any form of magnet or dynamo which gives a continuous current in one direction without a commutator. A. There are several machines that give a continuous current in one direction, but of low tension; the Siemens uni-polar machine and the Delafield uni-polar machine are examples.

(31) M. G. asks: What will take out scratches from a thick plate mirror? A. There is no way except to repolish with rouge on a flat buff of woolen cloth or felt. If the scratches are deep, none but those used to such work can grind out the scratches and repolish the whole surface.

(32) H. C. J. asks: Is there any porous substance that I can use in manufacturing a cheap water filter for my family use, that is better than charcoal? A. Nothing better than charcoal and sand; put the charcoal between the layers of sand. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 451.

(33) A. L.—For aquarium cement use 1 gill plaster Paris, 1 gill litharge, 1 gill fine white sand, one-third gill resin finely powdered. Mix thoroughly dry. Take what may be required for immediate use, and make a putty with boiled linseed oil and a little drier. Not too soft. Apply at once, as it sets quickly.

(34) L. K. asks: 1. Can an induction coil be used to produce an electric light, either arc or incandescent? A. Induction coils are in use for lighting by incandescents. 2. Is the quantity of electricity from an induction coil increased by using larger wire for secondary coil? A. Yes. 3. Would common clay crucibles do for porous cups for an electric battery? A. No; they are not sufficiently porous.

(35) J. F. B.—The horse pushes his collar, and it is by throwing his weight thereon that he pulls the street car.

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(36) H. B. S. asks: 1. Does the quality of a violin depend upon the kind of wood which it is made of? A. The quality of a violin is dependent upon the wood and upon the workmanship with which it is made. It improves as it grows old, and therefore its age is an important factor when its quality is considered. 2. If so, what kind of wood is best? A. Pine wood is used for the front and curly maple for the back. 3. Is there any work published in regard to the construction of the violin? A. We are not acquainted with any special book descriptive of the manufacture of the violin, but you will find a good deal of information contained in the various cyclopedias.

(37) H. H. asks how to make gum foam for soda water? A. Either of the following can be used with advantage: 1. To each gallon of sirup, add from 2 to 4 oz. of gum arabic dissolved in its own weight of water. 2. Quillaya bark, 4 oz.; alcohol, 4 oz.; glycerine, 4 oz.; water, 8 oz. Exhaust by percolation, so as to make 1 pint of tincture. From 2 to 5 drachms of this tincture to every gallon of sirup will be found sufficient to give every glass of soda water that creamy appearance so universally liked.

(38) E. D. F. asks how high a bicycle track should be banked on the outer edge of a 20 ft. broad track on the circle, the radius of circle being 120 ft., the rate of speed of wheelman to be 1 mile in 3 minutes? A. Under the speed named man and wheel will make an angle of 12½° to counteract centrifugal force on a 120 ft. radius. The radial grade of the track should incline 1 ft. in 5. But as this is for extreme velocities, we recommend only one-half this grade, or 1 ft. rise to 10 ft., or 2 ft. for your 20 ft. track. There will be no difference in the angle of inclination for differences of height in weight of man or vehicle.

(39) C. F. C. asks: 1. How many candle power is a German study lamp? A. About 20. 2. Candle power of an ordinary 4 ft. gas jet? A. About 12. 3. How large a single incandescent lamp the dynamo in SUPPLEMENT 161 will run? A. Five or 6 candle power of low resistance. 4. Can dynamo run an arc light? A. A very small one. 5. How can I construct a simple motor to be run by water in a large reservoir for driving the above dynamo? A. Make a small turbine water wheel.

(40) J. L. S asks: What the mixtures of varnishes are, that is, how to make the different kinds. 1. White varnish? A. A white hard spirit varnish can be made as follows: gum sandarac, 1 lb.; clear turpentine, 6 oz.; rectified spirits (65 over proof), 3 pints; dissolve. 2. Black varnish? A. Black varnish can be made by putting 48 lb. foreign asphaltum into an iron pot and boiling for 4 hours; during the first 2 hours introduce 7 lb. of red lead, 7 lb. litharge, 3 lb. dried copperas, and 10 gal. of boiled oil; add one 8 lb. run of dark gum with 2 gal. of hot oil. After pouring the oil and gum continue the boiling 2 hours, or until it will roll into hard pills like japan. When cool, thin it off with 30 gal. of turpentine or until it is of proper consistence. This varnish is specially adapted for iron work. 3. Common brown? A. A brown hard spirit varnish consists of sandarac, 4 oz.; pale seed lac, 2 oz.; elemi, 1 oz.; alcohol, 1 qt.; digest with agitation till dissolved, then add Venice turpentine, 2 oz.

(41) J. R. D. desires to know some preparation that will cause tender skin to become hard and callous? A. Almost any astringent substance will accomplish this purpose, and therefore various solutions, such as vinegar, dilute sulphuric acid, lemon juice, or alum water, may be employed. Rub the parts to which the liquid is applied, and slap them well.

(42) F. W. B. asks: 1. Why is the N. Y., C. & St. L. Railroad called the Nickel Plate? A. We believe it was a nickname given because its founders represented it to be superior to any other road, so the story was that they were not satisfied with steel rails, but must have them nickel plated. 2. What is the best fillings between brick walls for a fireproof safe? A. Bricks are very good; a mixture of plaster of Paris and alum is much used. Fine sand offers a very good protection against fire. 3. Can an iron body be suspended by a magnet, or held in the air, without being in contact with it, that is, is it possible to balance the action of gravity on the weight by the attraction of the magnet so nicely as to keep them a given distance, say one-half inch, apart? A. You can accomplish this by means of an axial magnet.

(43) F. B. W. asks: 1. How to smoke glass slides for magic lanterns, so the black won't come off? A. You can smoke glass over a small gas flame or over a candle. You can cause it to adhere by subjecting it to steam of alcohol. 2. The way to paint on slides for same purpose? A. For information on lantern transparencies consult SUPPLEMENTS 423, 173, 424. 3. How to get pictures from newspapers transferred to slides, so that they will be transparent? A. Coat the glass with mastic varnish, allow the varnish to become sticky, place the print face down upon the varnish surface and burnish it well, so that all parts of the paper will be brought into contact with the varnish, and when the varnish has become thoroughly dry, moisten the paper and rub it over with the fingers until it is all removed, leaving the print in the varnish. Finally brush the print over lightly and quickly with a very thin coat of varnish.

(44) W. K.—For elastic moulds, rubber is probably the most durable material. The composition of printers' rollers is 8 pounds glue dissolved to a jelly by water, then add 7 pounds molasses. With the amount of water in the smallest proportion to give it elasticity, a very elastic mould may be made. Another composition used for the hektograph, and also for printers' rollers, is made with 1½ pounds good white glue soaked in water until soft, the water poured off and 6 pounds glycerine added, and the whole melted and boiled until the right consistency is obtained by cooling a small quantity for trial. The object to be moulded must be greased to prevent sticking.

(45) A. A.—The brass coated zinc plaques are electro-plated. For the brass bath: 4⅓ gallons pure water, bisulphate of soda 24½ ounces, cyanide of potassium 35 ounces. Dissolve, then add the following solution: Water 9 pints, acetate of copper and protochloride of zinc each 12½ ounces, aqua ammonia 14 ounces. Or in proportion of all the above for a smaller bath. Filter the bath; it will then become colorless, and gives under the action of a battery a brass deposit of a very fine shade, using an anode of brass. By slightly changing the proportions of acetate of copper and protochloride of zinc, the tints may be varied from reddish yellow to greenish yellow. A little experience will be required to adjust the strength of the batteries—a weak battery producing a red deposit, a strong battery producing a gray deposit.

(46) O. O.—We do not know that the limit of speed in wheels has ever been reached. The limit is entirely controlled by friction of the mechanical parts and the medium in which the revolving motion takes place. About 10,000 revolutions per minute has been obtained in machinery practice. We do not know why 50,000 or 100,000 may not be obtained *in vacuo*.

(47) C. M. asks: If a perfect circle is made with a very fine silver wire, and then, by means of four rims, the wire transformed into a perfect square, what is the difference in the result of this process and that of squaring the circle? A. The area of a circle is greater than that of any square whose sides only equal circumference of the circle. For instance, a circle 8 inches in diameter has an area of 50·2656 inches, and the circumference of such circle is 25·1328 inches. To inclose the same area in a square, its sides must be 7·0898 inches each, or 28·3592 for the four sides.

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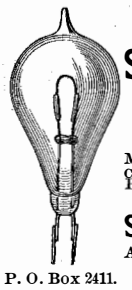

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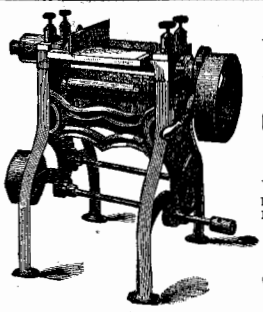

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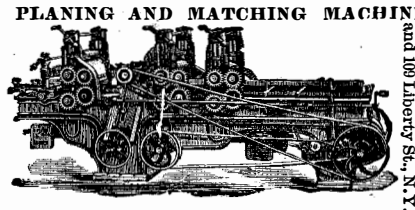

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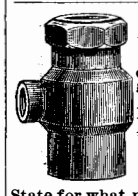

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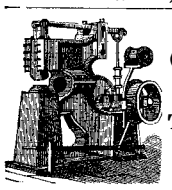

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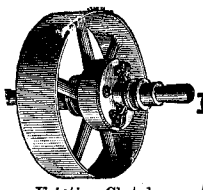
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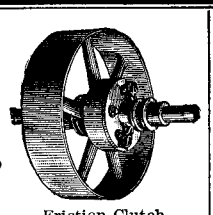
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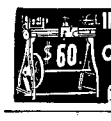

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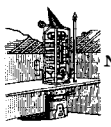

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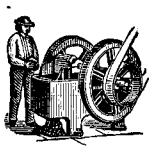

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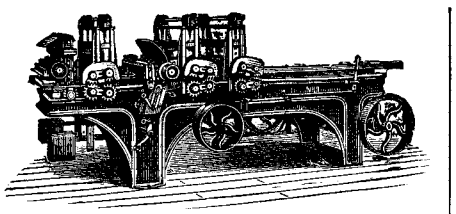

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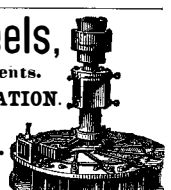

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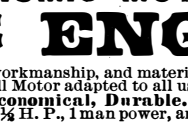

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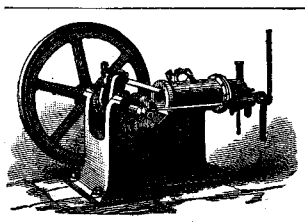

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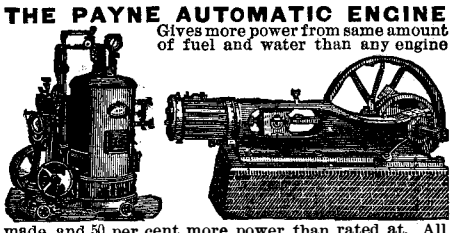

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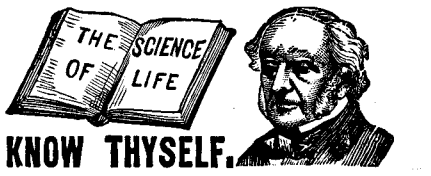

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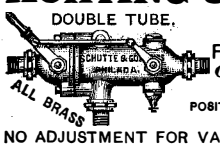

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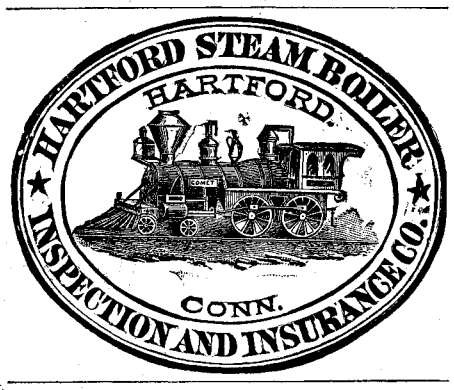

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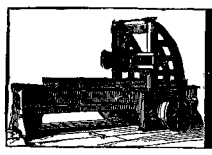

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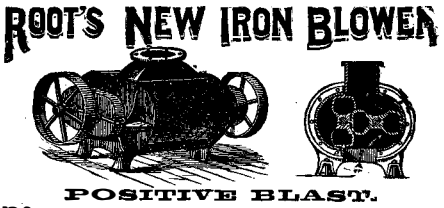

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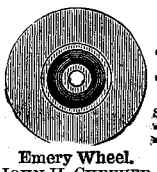

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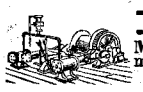

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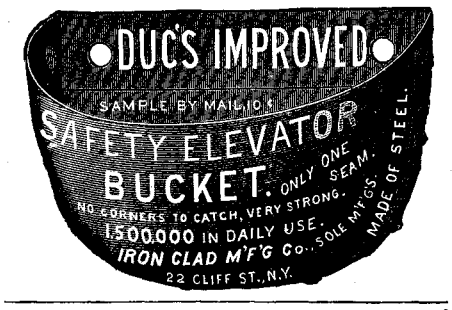
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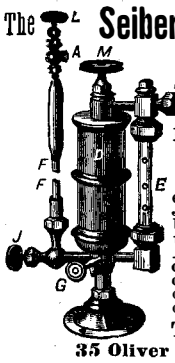

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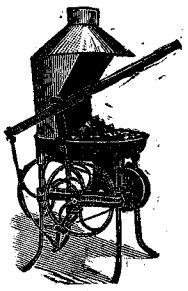

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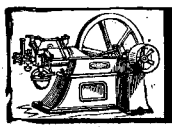

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